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2200—Range
November 1988
8822 2807

Vegetative Rehabilitation & Equipment Workshop

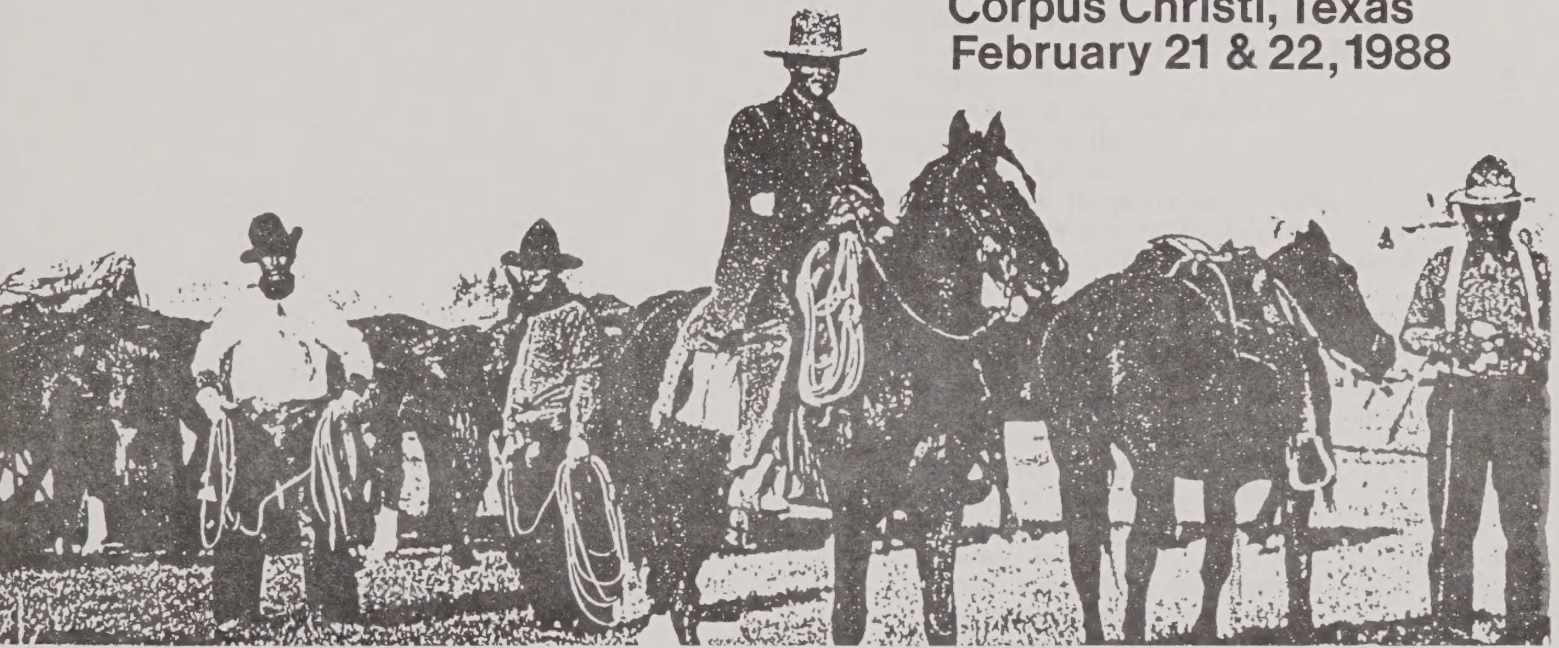
42nd Annual Report
Corpus Christi, Texas
February 21 & 22, 1988

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Vegetative Rehabilitation & Equipment Workshop

**42nd Annual Report
Corpus Christi, Texas
February 21 & 22, 1988**



PARTICIPANTS

U. S. Department of Agriculture
U. S. Department of the Interior
State and County Organizations
State Wildlife Agencies
Industry Representatives
(Chemical, Equipment, Mining, Seed)
Education Institutions
Ranchers
Foreign Countries

NOVEMBER 1988

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Chairman's Letter

June 15, 1988

Dear VREW Participants:

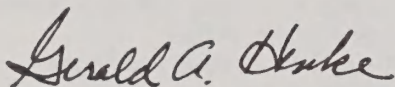
The VREW session held in Corpus Christi, Texas, February 21-22 was a milestone session. This session had very active participation from the "Commercial Exhibitor's". Their contributions to VREW are welcomed and allow exhibitors an opportunity to discuss innovative ideas and product development that is important in the management of range resources. Approximately 140 people attended this year's meeting.

Planning for the 1989 VREW program is underway. Your active participation and comments on VREW activities are always welcomed. It is always important to look into the future and discuss the needs and opportunities for range and rehabilitation equipment. If you have suggestions on workshop topics, please contact me. The budget for VREW continues to be reduced and no signs of a change are in sight.

The first in a series of books is now off the press by the Missoula Technology and Development Center that provide the standards for structural range improvements such as fences, cattleguards, and spring developments.

The 43rd Annual VREW meeting will be in Billings, Montana. Hope to see each of you there.

Sincerely,



GERALD A. HENKE

Chairman, Vegetative Rehabilitation
and Equipment Workshop

Sunday, Feb. 21

Opening Remarks Gerald Henke, Chairman
Vegetative Rehabilitation and Equipment Workshop

Range Research in Texas Dr. Joe Schuster, Head
Range Science Dept.,
Texas A&M University
College Station, TX

Ag-Renewal Weldon Miller
Woodward, OK

Willamette Seed Company Larry Lilly
Albany, OR

Casterline and Sons Fred Casterline
Dodge City, KS

Garrison Seed and Grain Co. Art Stoy
Hereford, TX

Twin Mountain Supply Dr. Bob Steiger
San Angelo, TX

Sharp Bros. Seed Co. Art Armbrust
Healy, KS

Challenger 65—A New Innovation
by Caterpillar Bill Reno, Supervisor
Ag. Section, Sales Development Dept.
Peoria, IL

“Sourcing Seed for CRP”
Panel Discussion Moderator: Wendall Oaks
Soil Conservation Service
Albuquerque, NM

Benavides Ranch—Range Improvements
in Mexico Trinidad Benavides
Benavides Sociedad de Produccion
Rural de R.S.
Nuevo Laredo, Tamaulipas, Mexico

Arid Land Seeding Harold Wiedemann, Chairman
Texas Agricultural Experiment Station
Vernon, TX

Thermal Plant Control Glen Secrist, Chairman
BLM
Washington, DC

Monday, Feb. 22

Chaparossa Ranch—Range Improvements
in South Texas Dr. Pat Reardo
Chaparossa Ranch
La Pryor, T

New Products of Dow Chemical Bob Capr
Dallas, T

New Products of E.I. DuPont Jim Marase
Cypress, T

Information and
Publications Dick Hallman, Chairma
USDA Forest Service
Missoula Technology and Development Center
Missoula, M

Plant Materials Wendall Oaks, Chairma
Soil Conservation Service
Albuquerque, NM

VREW Business Meeting Gerald Henke, Chairma
Vegetative Rehabilitation and Equipment Workshop

History and Progress of VREW

Dan W. McKenzie, Forest Service, San Dimas, California
Text from *History of the Vegetative and Equipment Workshop (VREW) 1946-1981*, USDA Forest Service Missoula Technology and Development Special Report 8222 2805, 1982.

The Vegetative Rehabilitation and Equipment Workshop (VREW) is an informal organization interested in developing and testing revegetation equipment and providing information about suitable equipment to land managers. Formerly known as the Reseeding Equipment Development Committee (1946-1958) and, later, as the Range Seeding Equipment Committee (1958-1974), VREW is mainly concerned with equipment for rangeland improvement and disturbed land reclamation.

VREW is an informal, ad hoc group without by-laws, membership requirements, or dues. Meetings are held each winter, usually in conjunction with, and just prior to, the annual meetings of the Society for Range Management. Most of the workshops have been held in the Western United States. Workshop participants review accomplishments,

discuss development activities, and present new information concerning revegetation equipment or techniques.

VREW includes representatives from Federal and State agencies, universities, industries, and other organizations. Foreign countries such as Canada, Mexico, Kuwait, Niger, Morocco, Kenya, Argentina, and Australia contribute to the VREW. Several Federal agencies are also actively involved in VREW. Major funding agencies have been the Forest Service (FS), the Agricultural Research Service (ARS), the Extension Service-Natural Resources (EXT-NR), and the Soil Conservation Service (SCS) from the Department of Agriculture (USDA); and the Fish and Wildlife Service (WS), the Office of Surface Mining (OSM), the Bureau of Indian Affairs (BIA), and the Bureau of Land Management (BLM) from the Department of Interior (USDI). State agencies such as Fish and Game departments, Highway departments, and extension services have contributed personnel and facilities for field tests and evaluation. In recent years, industries, including equipment manufacturers, seed suppliers, mining companies, ranches, and consulting firms, have become increasingly involved in VREW.

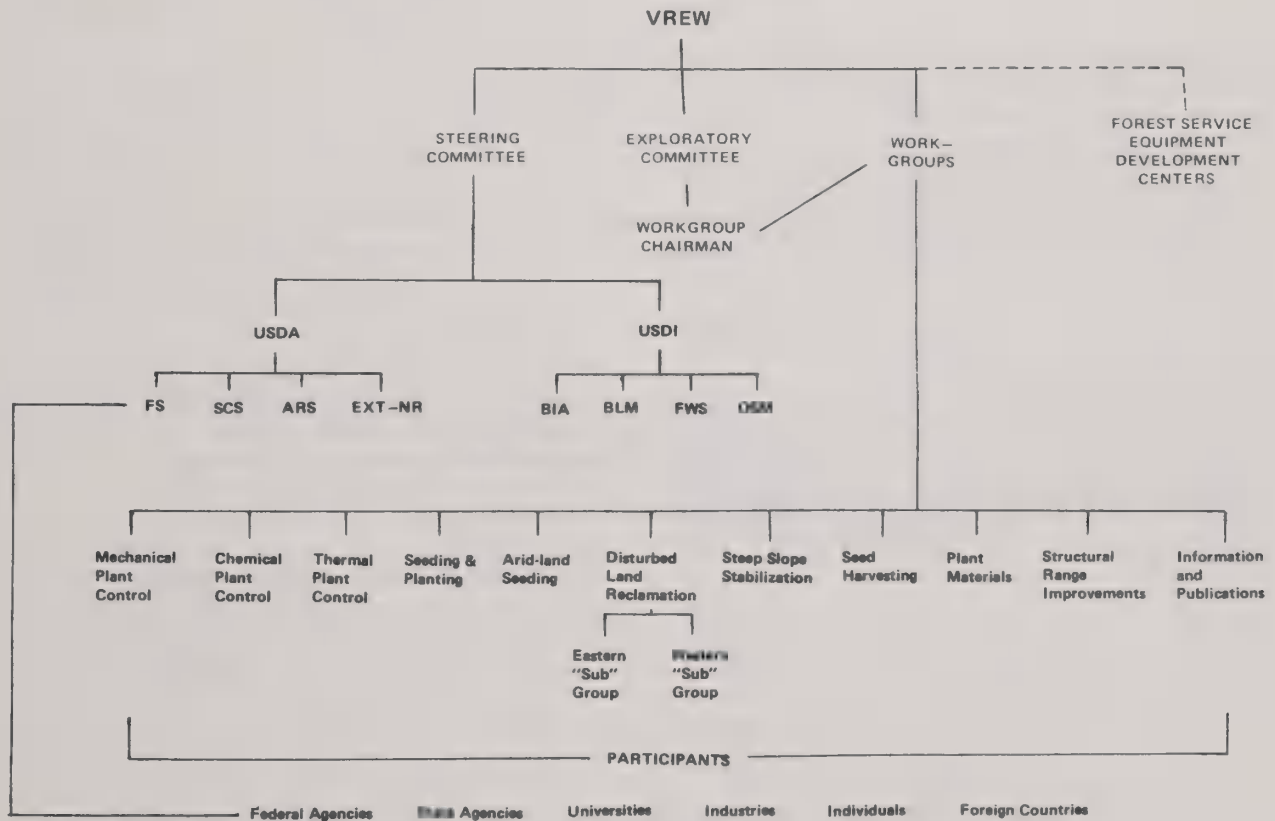


Figure 1.--Organization of the Vegetative Rehabilitation and Equipment Workshop (VREW).

The chairman of VREW has traditionally been the Assistant Director of the Forest Service Range Management Staff in charge of Cooperative Programs (Fig. 1). This allows administration and coordination of range and resource programs with the Equipment Development Centers at San Dimas, Calif. (SDEDC), and Missoula, Mont. (MTDC). The VREW Chairman handles many of the administrative details of the workshop, acts as a liaison among agencies, and heads both the Steering and Exploratory Committees of the workshop.

The steering Committee comprises representatives from each major funding agency. They examine the projects and set priorities according to field needs, then assign the approved projects to existing workgroups or, if necessary, create new workgroups to accomplish special projects. Workgroups that have accomplished their purpose are phased out or incorporated into other workgroups.

The Exploratory Committee is composed of the chairmen of the VREW workgroups, members of the Steering Committee, and selected personnel from the Technology Development Centers. It meets annually to examine project proposals for VREW. Project proposals originate from a variety of sources including surveys of field personnel, spin-offs from previous development work, and suggestions from researchers, ranchers, or other interested individuals.

The workgroups are responsible for developing project proposals, monitoring progress, directing field testing, evaluating results, and discussing new developments in their areas of interest. Each workgroup also reports its activities to the entire VREW organization during the annual meetings. These reports, along with papers presented during the meetings, are published every year. All VREW reports are distributed on an extensive mailing list compiled for VREW.

Workgroup meetings are held several times during the year at the discretion of the workgroup chairmen or at the convenience of the members. The cohesion and structure of VREW are largely maintained by the various workgroups. Members generally have varied backgrounds and are drawn together by common interests. The workgroup structure fosters cooperation and promotes good working relationships among individuals from various agencies, industries, and organizations.

VREW works very closely with the Forest Service Technology Development Centers where most of the actual project work takes place. SDEDC and MTDC planners, project leaders, and support staff identify equipment needs, evaluate commercially available equipment, design, construct, and test equipment, and publish reports, films, and slide tapes. In addition, they provide technical services that involve answering routine requests, maintaining and updating drawings and specifications, attending seminars and special

courses, and determining the benefits and cost of equipment development projects.

Many successful development projects and other accomplishments have resulted from the unselfish cooperation that has been characteristic of VREW. These efforts serve as an example of what can be done through cooperative efforts. Membership is open to anyone interested.

VREW's roots go back to World War II, when more wool and beef were needed to sustain the war effort. With increased demand for sheep and cattle, officials sought to increase productivity from National Forest rangelands. However, many of these lands, already suffering from a long history of abuse, could not support additional livestock without substantial improvement. Range seeding had been demonstrated by small-scale tests in the 1930's, but additional research was necessary to implement large-scale seeding efforts. The research was approved and seeding tests were initiated throughout the West.

The range seeding test program proved successful, but several problems needed to be solved before it could be effectively expanded. A major problem was that the equipment commercially available at that time was designed for crop production on farmland and was poorly adapted to the rough terrain, rocky ground, steep slopes, and dense brush encountered on rangeland.

A conference of Forest Service researchers and administrators was held in 1945 to discuss the state-of-the-art in range seeding and what needed to be done. Participants at the conference recognized that a major effort was needed to test, adapt, or develop suitable equipment for range seeding and other improvements. An interregional administrative research committee was established to work with the staff at the Forest Service Equipment Development Center at Portland, Oregon. Center personnel joined the group to add their expertise to help solve rangeland equipment problems. The Center also provided the necessary facilities and equipment for the development efforts. Eventually this work was moved to the Center at Arcadia, California. In the late 60's some range equipment development work was started at MTDC.

The conference group became known as the Reseeding Equipment Development Committee. In 1958, it changed its name to the Range Seeding Equipment Committee, and, later, became VREW. The first formal committee meeting was held in Portland, Oregon on Dec. 9-11, 1946.

A. Denham, L.A. Dremolski, T.P. Flynn, A.C. Hull, F.H. Kennedy, and J.F. Pechanec attended and J.F. Pechanec was appointed chairman. Other chairmen throughout the years have been A.C. Hull, W.W. Dresskell, W.D. Hurst, F.C. Curtis, F.J. Smith, J.S. Forsman, A.B. Evanko, B.F. Currier, J.S. Tixier, V.L. Thompson, and T.V. Russell.

During the first meeting, the committee formed a charter to "Consider, evaluate, and assign priorities to equipment problems suggested by the several Forest Service Regions . . . prepare a program of work each year for the Forest Service Equipment Laboratory to follow . . . (and) perform an essential function by drawing up specifications for the most desirable makes and models of equipment for range seeding."

The committee worked closely with the Equipment Development Center. Ted P. Flynn, Tom Coldwell, and Gene Silva of the Centers kept up enthusiasm and contributed to the success of many early projects.

The first few annual committee meetings were attended exclusively by Forest Service personnel from various Regions and Stations. After the American Society for Range Management (later the Society for Range Management) was founded in 1948, the Range Seeding Equipment Committee met at the same time to encourage attendance at both meetings.

Other agencies soon became interested in the Range Seeding Equipment Committee. Representatives of the BLM and SCS attended the committee meeting at Denver, Colorado, in January 1949. A great deal of controversy existed at that meeting concerning the name and purpose of the committee. The debate resulted in a better understanding of the committee charter. Later that year the committee objectives were expanded to: "1) Evaluate available equipment suitable for range seeding (and brush control) and if none is satisfactory, suitable equipment (shall) be designed, constructed, and tested under guidance of the committee; 2) Prescribe specifications and standards for purchase, maintenance, and use of equipment and materials; 3) Function as a clearing-house for . . . information, and 4) Act in an advisory capacity . . . in range seeding and undesirable plant control policies and procedures."

At times, the survival of the Range Seeding Equipment Committee seemed doubtful. Attendance at most of the early meetings was low. However, the enthusiasm and dedication of committee members attracted other land managers facing similar equipment difficulties. As committee efforts expanded, several other agencies became involved in committee meetings and activities. In 1951, BLM first contributed funds for committee projects. The BIA and SCS added financial support in 1955 and 1956, respectively. Interagency participation and funding has helped insure the survival and success of the Range Seeding Equipment Committee and VREW.

During the 1955 meeting, the committee decided to function as an informal organization without restricting membership or participation by interested agencies or individuals. This structure has encouraged participation from groups with diverse interests and has promoted a free exchange of information. Over the years, many Federal agencies, State agencies, universities, and industries have cooperated with the committee, and VREW, by contributing funds for special projects, participating in field operations and evaluation, or supplying materials and equipment for testing.

The informal structure and extensive cooperation have helped VREW accomplish its stated goals.

The Vegetative Rehabilitation and Equipment Workshop, VREW, is a forum to provide exchange of ideas to enhance the development and dissemination of technology used in improving rangelands and surface-mined soils. To better identify an equipment development project, VREW may:

1. Promote an understanding of the ecology of the land to be treated as a first step in modifying or designing new equipment.
2. Utilize cost efficiency in evaluating proposed projects for selection.
3. Improve equipment evaluation through consultation with interested or affected Federal, State, and private organizations, and individuals.

The scope of VREW activities has inevitably broadened since the committee began. Investigation and development efforts have moved from seeding and seedbed preparation equipment to mechanical plant control, chemical application, prescribed burning, contour furrowing, water developments, structural improvement, seed gathering, and related functions.

The Range Seeding Equipment Committee formally changed its name to Vegetative Rehabilitation and Equipment Workshop (VREW) in 1974 to better reflect the diversity and broadened scope of its support and interest. Today, most Federal and several State land management agencies are represented in VREW. In addition, universities and industries are becoming increasingly involved. VREW activities range from evaluating improved seedboxes for rangeland drills to establishing a computerized inventory of suitable plant materials.

A growing emphasis is also being placed on collecting and distributing current information about equipment and techniques for rangeland improvement and disturbed land revegetation. The Range Seeding Equipment Committee has supplied several useful publications, including the *Range Seeding Equipment Handbook*, *Chemical Control of Range Weeds*, *Operating Hints for Equipment Used in Range Revegetation* and others.

VREW is increasing the effort to provide land managers with pertinent, up-to-date information. Much of this information is published in newsletters, Equip Tips, Project Records, VREW annual reports, service and parts manuals, operations handbooks, and the *Catalog—Revegetation Equipment*. These publications should help land managers make informed choices about available equipment and techniques for their specific needs.

VREW equipment development and test (ED&T) projects have encompassed a wide variety of needs. VREW achievements have resulted in effective and economic improvements of many rangelands, critical watersheds, and other areas that might not have been possible otherwise. The interest, dedication, and cooperation among VREW members has produced a unique combination of knowledge, talent, and experience necessary to meet the growing demand for range rehabilitation equipment and techniques. VREW will continue to supply new ideas, better equipment, and current information as long as this demand persists.

Range Research in Texas

Joseph L. Schuster, Professor, Head of Department of Range Science, Texas A&M University, College Station, Texas 77843-2126

Approximately 57 percent or 95 million acres of Texas is classified as rangeland that is 97 percent privately owned. These rangelands have many products and uses vital to the economy of Texas. They provide the forage base for the livestock industry. Gate receipts for cattle and calves total some \$4.5 billion annually. Rancher income from sheep, goats, wool, and mohair exceeds \$160 million annually. The state's \$14.5 billion recreation and tourism industry depends upon the space, aesthetic beauty, and recreational assets of Texas rangelands. Recreational hunting has become a boon to the rancher with over \$100 million received annually by land owners for leasing trespass rights to hunters. A 3.5 multiplier factor adds another estimated \$350 million to the state's economy in support of hunting. Texas is unique in that over 60 percent of the water used by industry flows off rangelands. The rivers that drain the rangelands replenish the state's major aquifers and supply water to the state's major metropolitan areas. The state's major reserves of oil, gas, lignite, and uranium are found under rangeland.

The goal of the Texas A&M University's range management program is to generate basic biological information and management practices useful in rangeland production systems.

The range research and extension program is supported mostly by state and federal funds plus funds from a vigorous grant program. The nucleus of range science expertise is located on campus at College Station, with a network of range scientists located strategically in the major range resource regions of the state (Figure 1). Research scientists are located at the Vernon, San Angelo, Uvalde, and Corpus Christi Research and Extension Centers. Thirteen research scientists in the Range Science Department at College Station and eight research scientists located at the centers provide the equivalent of 13.5 science years (SY's) of range related research. These scientists are supported by some twenty research associates and technicians. The research program is closely coordinated with the extension program throughout the state. Three state extension range specialists located on campus work statewide and five area extension range specialists serve the extension districts in the western part of the state.

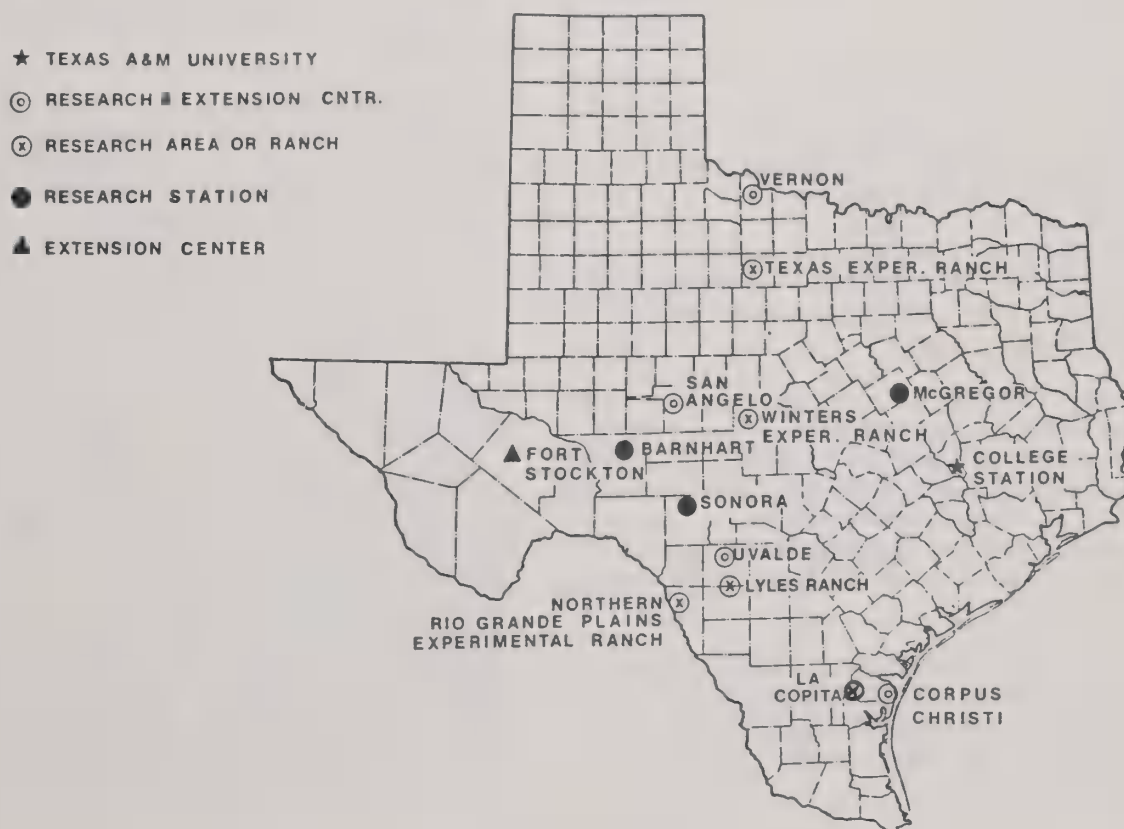


Figure 1.—Locations for range research and extension.

Long-term range management research objectives are: (1) develop technologies that will increase production efficiency, reduce risk, and conserve the range resource; (2) effectively integrate range management systems into operational objectives of the ranch firm; and (3) develop practical, ecologically sound, and economically viable management alternatives for major range production areas of the state.

Traditional disciplinary research has produced significant technology useful to ranchers. Examples of brush and weed control research application are: (1) efficacy of herbicides such as 2,4,5-T, picloram and tebuthiuron; (2) aerial spraying techniques, carriers, and timing; (3) engineering innovations such as the low-energy grubber and the range seeder; (4) prescribed burning techniques; and (5) the development of integrated brush management systems using various combinations of the above technologies.

Grazing management research has provided basic biological data and grazing management technologies. Examples include: (1) intensive grazing management systems such as the 4-pasture, 3-herd deferred-rotation system; the high-intensity, low-frequency system; and the rapid-rotation grazing system; (2) combination stocking utilizing cattle, sheep, goats and deer; and (3) many wildlife/livestock diet relationships.

The strategic planning process used by the Texas Agricultural Experiment Station calls for development of prioritized research needs utilizing producer, extension, and other service agency inputs. The current research plan identifies the following major needs in range research:

1. Develop Technologies for Improving Range Plants and Communities. This includes basic biological and ecological research on individual range plants and communities.
2. Develop Flexible Strategies for Multiple Use of Rangeland Resources. The complexities of total resource management from both the biological and economic standpoints dictate the development of better decision information systems and procedures to identify, collect, analyze and store information relative to strategic planning and tactical and operational management decisions.
3. Improve Water Conservation and Erosion Control on Rangeland Watershed. This need is aimed at determining the best range management practices for on-site water use, erosion control, and off-site water quantity and quality.

4. Manage Brush, Weed, and Toxic Plants on Rangeland. Planned research efforts for this need include traditional research efforts such as specific pest control strategies but emphasize development of integrated brush management systems designed to optimize output of all range products.
5. Develop Technologies for Optimizing Livestock and Wildlife Production on Rangeland. Plans are to continue basic biological studies in nutrition and grazing management, but an expanded interdisciplinary team effort is under way which integrates biological research efforts in plant/animal interactions with managerial decision-making processes to allow development of ranch firm level decision support systems on grazing management and nutrition.
6. Develop Improved Methodology for Resource Classification and Inventory. Better methodology is necessary to fine tune production systems and to monitor applications.

The research approach adopted to meet these needs utilizes: (1) a systems approach to rangeland resource management, (2) insures integration of range management systems into operational objectives and capabilities of the ranch firm, and (3) includes all products and uses of the range in an interdisciplinary effort.

Inter disciplinary efforts include five major areas of expertise in range supported by, and in collaboration with, several disciplines and departments such as Agricultural Economics, Agronomy, Animal Science, and Wildlife Science. Traditional disciplinary research is oriented toward development of new knowledge in the major expertise areas of watershed management, brush management, grazing management, range nutrition, and ecology. Additionally, interdisciplinary teams have been developed in integrated range resource management, water management, and grazing management. These teams include the expertise and specialties needed to attack problems identified by the team (Figure 2). For example, the Integrated Grazing Management team (IGM) includes not only the grazing management specialists but ecophysiologists, ecologists, animal nutritionists, and economists. The Range Water Management team (RWM) involves hydrologists, rehabilitation specialists, ecologists, and a systems modeler. The Integrated Range Resource Management Systems team (IRRMS) includes inputs from a brush scientist, shrub ecologist, economist, grazing management specialists, and wildlife scientist. A systems scientist/modeler provides systems modelling and knowledge engineering support to each team. Extension specialists on the IRRMS and IGM teams provide technology need inputs and facilitate transfer of new technologies.

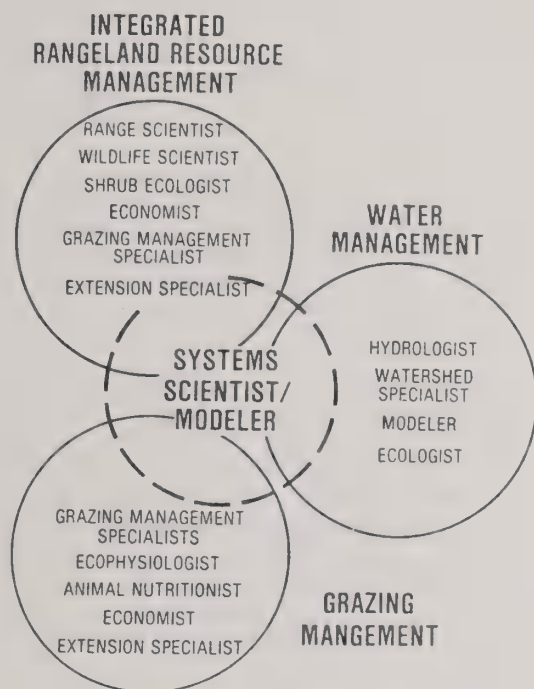


Figure 2.—Interdisciplinary range research teams.

Including an Extension specialist on the teams integrates the extension component with the information generation element (Figure 3). It ties the team and individual research efforts to the information delivery system. The teams are supported by disciplinary research in ecology that generates basic biological information on how the range ecosystem functions. The research teams are interconnected through joint members and shared objectives. For example, integrated range management systems are evaluated on their effect on water yield and wildlife habitat as well as their efficiency in converting brushland to grassland for livestock production.

Information generated by the research teams is filtered through economic analyses to isolate economically sensitive variables and identify economically viable technologies. Viable alternatives emerging from this process are made available to ranch owners and managers in the context of new technology and management decision aids. Computer enhanced decision aids include production models, decision support systems, and expert systems. The final product of the coordinated effort is delivered to the county level via the information dissemination system of the Texas Agricultural Extension Service. In this way, basic biological information and management practices useful for production systems in the various regions of the state are developed and delivered to the users, fulfilling both our research and our extension objectives.

Functionally, the existing IRRMS team concentrates on problem solving in South Texas with major research on the La Copita Research Area near Corpus Christi. Plans are to establish similar teams in West Texas and North Texas (Figure 4). The RWM team and the IGM team are more disciplinary in nature and support statewide needs.

In summary, the state's rangeland resources provide significant food, recreation, water, and other products to the economy. The range research program through a systems approach utilizing individual disciplinary research and inter-disciplinary teams develops technologies and decision aids useful in production systems. This effort is integrated with the extension range program assuring delivery to the user.

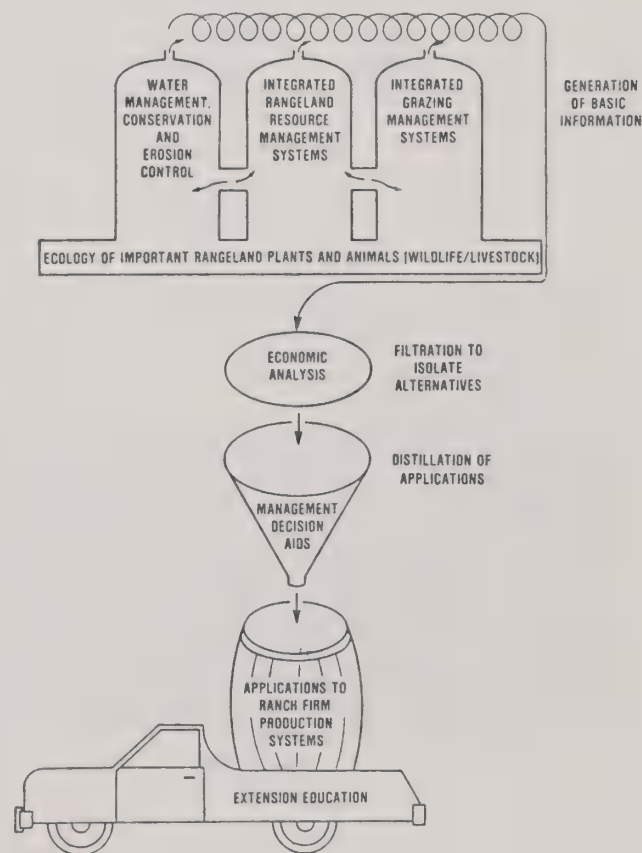


Figure 3.—Range science research/extension program (team approach).

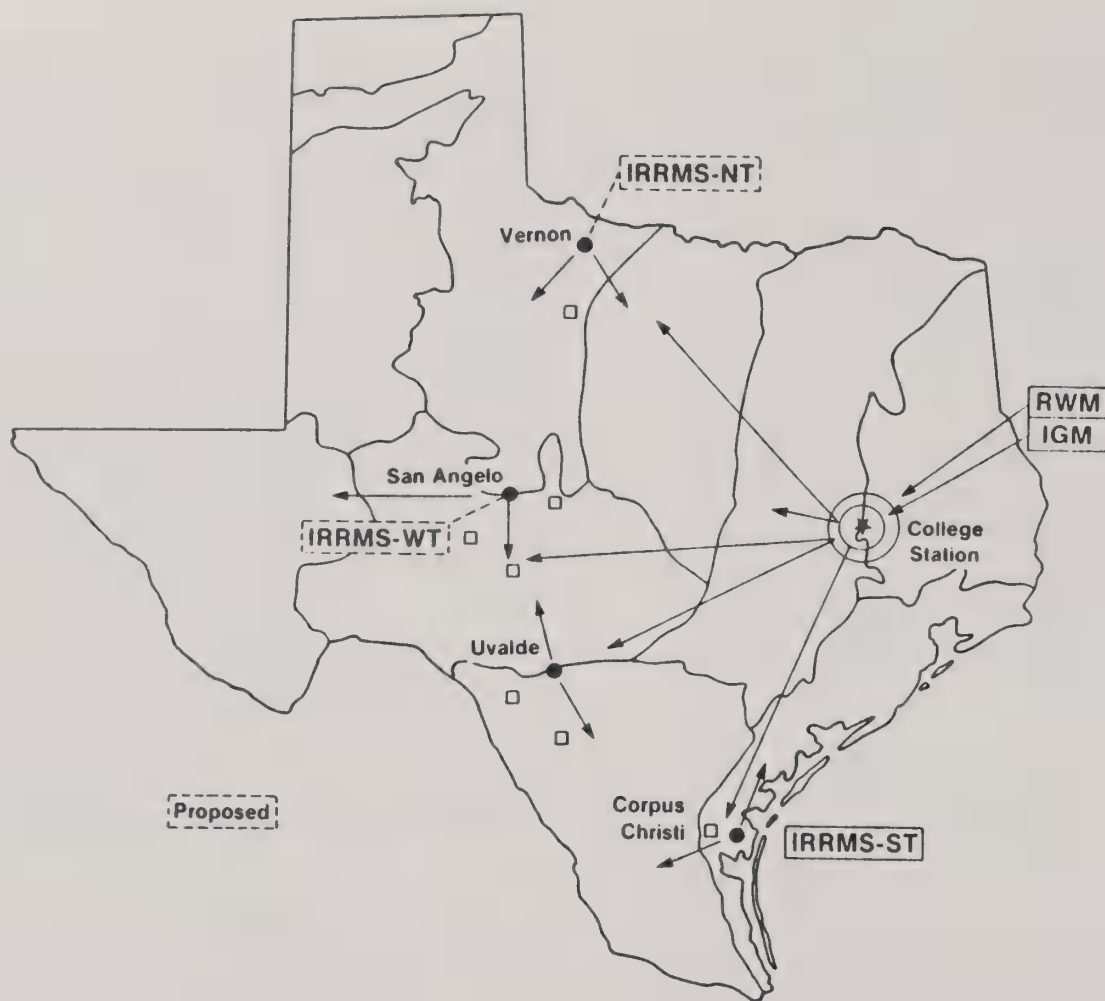


Figure 4.—Range research team locations.

The Story of the Commercial Development of Seed Equipment Developed at USDA Research Stations

Weldon Miller, President, Ag-Renewal, Inc., Weatherford, Oklahoma 73096

Ag-Renewal, Inc., is a rapidly growing company, providing quality goods and services to forage producers to help them better manage their forage businesses. The history of Ag-Renewal, Inc., is typical of many farmer businesses, in that a series of farm business decisions led to a full-time farm agribusiness.

Ag-Renewal, Inc., manufactures and markets three items developed at the USDA-ARS research station in Woodward, OK, patented by Aaron Beisel, Fargo, OK, farmer-inventor. These items, in development since 1981, have enabled farmers to take advantage of the CRP program, and to harvest, process, and market seed from their own farms and ranches. The three items are the Woodward Flail-Vac Seed Stripper, the Hi-Intensity Scalper Seed Cleaner with Fluidic Seed Classifier, and the Woodward Laboratory Air-Seed Shucker. Following is a description of these items.

Woodward Flail-Vac Seed Stripper

A new rotary brush “stripper” that attaches to a tractor front-end loader and selectively harvests only mature seed is revolutionizing grass seed harvesting. It allows you to harvest high quality, high purity seed—without the hit and miss guesswork of harvesting with a conventional combine. The new Woodward Flail-Vac replaces the bucket on your tractor’s front-end loader. It takes a 12-foot swath and is equipped with a 21-inch diameter cylindrical nylon brush which, operating at 300 to 600 rpms, strips mature seed off standing plants.

Unlike a combine sickle, which cuts plants off and harvests everything—including green seeds in varying stages of maturity, plus a lot of sticks and trash—the Stripper harvests only ripe seed and leaves the plant intact, allowing later-maturing seed to ripen on the standing plant. Most owners generally go through fields four and five times over a 3 to 5 week period depending on weather conditions, to strip off seed as it matures.

Operating field speed is generally between 6 to 9 mph. The brush turns with an upward motion, just opposite that of a combine reel, to strip seed off erect-standing plants with virtually no shatter loss. It’s not uncommon for farmers to bring seed with 90 percent or higher purity right out of the field on each pass, compared to only 25 to 40 percent purity with a combine. Combines can cover more acres, but they’re generally not nearly as productive when you figure total net pounds of pure seed harvested from a field.

The new Woodward Flail-Vac, invented by Aaron Beisel, an Oklahoma farmer, has been field tested for 5 years throughout the entire U.S. The latest new 12-foot wide production model is all-aluminum and weighs only 750 pounds. It’s light enough so you can use it with tractors as small as 50 to 60 hp. This makes the machine especially popular with custom grass seed harvesters. Instead of having to move big combines from farm to farm, all you need is a small trailer to carry a smaller tractor equipped with a loader and our new aluminum Flail-Vac. Its nylon cylindrical brush, made up of 7.5-inch long bristles spiraled onto the cylinder, is powered by a completely independent, pto-driven hydraulic system. You use the tractor’s hydraulic system to raise and lower the loader to match operating height of the Flail-Vac with height of the crop being harvested. The machine has a built-in hopper that self-empties into a truck or wagon simply by raising the loader.

There are two models available, the 12-foot wide and the 6-foot wide. The 6-foot model is used mainly for research.



Woodward Flail-Vac seed stripper.

Woodward Laboratory Air-Seed Shucker

The Woodward Laboratory Air-Seed Shucker gives rapid extraction of caryopses (grain) from chaffy seeded species.

Operation: Air from your compressor operated at 90 psi to furnish 7 cfm, produces a blast and supersonic acceleration to strip the chaff from the grain. Seeds that are not completely shucked are recycled until shucking is complete. Clean grain exits the unit against a vacuum resistance that holds the trash within the unit.

Specifications:

Dimensions: 23 inches x 10 inches

Weight: 5 pounds

Power Source: Air Compressor (90 psi)

Fabrication: Aluminum

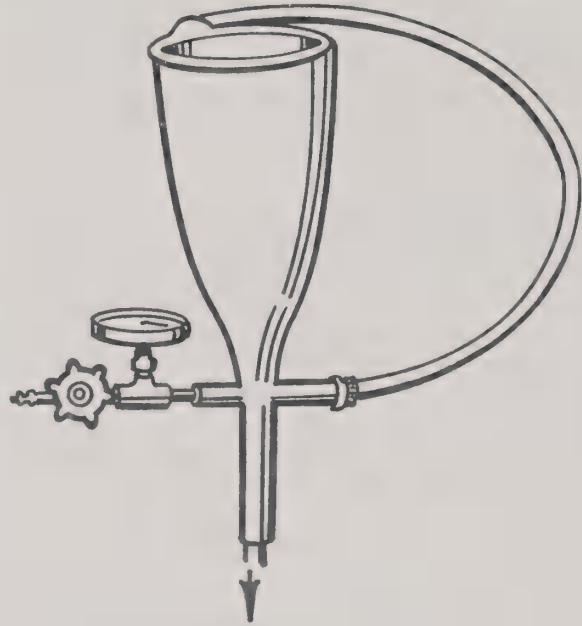
Seed Producers and Commercial Harvesters: Determines pure grain content to monitor the optimum timing for seed harvest.

Other Uses:

Seed Testing Laboratories—Determines pure grain content and frees the grain for additional tests, i.e., germination, tetrazolium, etc.

Seed Processing Plants—Monitors the efficiency of various equipment while reducing seed losses by helping the operator select proper screen sizes and amounts of air. It also helps locate weed seed so adjustments can be made for more efficient weed seed removal.

The Woodward Laboratory Air-Seed Shucker is currently being manufactured. The unit price is \$1,000, F.O.B. Weatherford, Oklahoma.



Woodward Laboratory Air-Seed Shucker.

Hi-Intensity Scalper Seed Cleaner

Specifications:

Weight: approximately 225 pounds

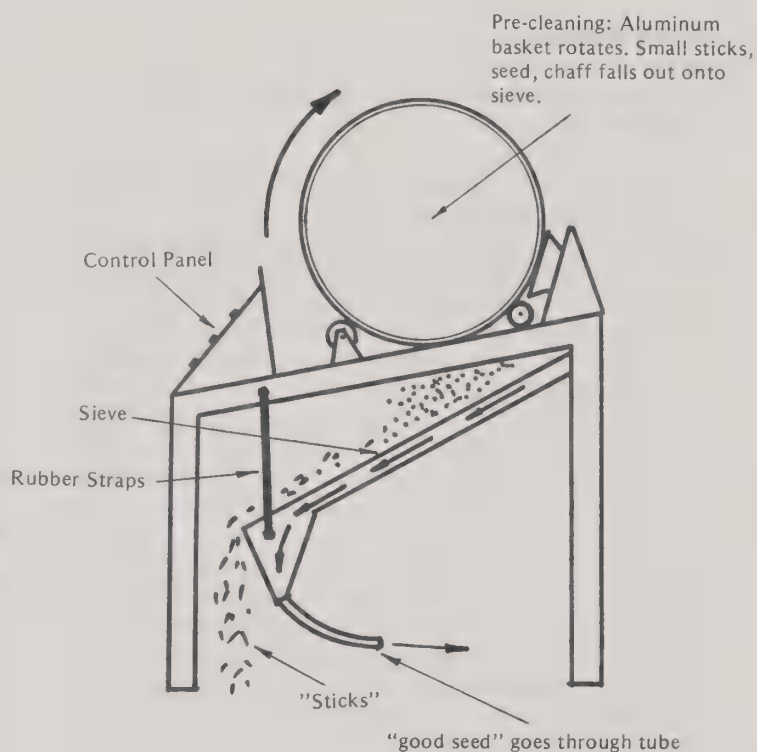
Dimensions: 40 inches x 53 inches x 55 inches

Fabrication: Aluminum with steel frame

Power requirements: Air Compressor
20 to 25 cfm

Lubrication: Air tool oil (included)

Cleaning Process: Hi-intensity vibration separates the sticks from the seeds. The sticks fall off the front while the seed drops through the sieve and is transferred pneumatically to either the Fluidic Classifier (then into the seed bag) or directly into the seed bag.



Hi-intensity scalper seed cleaner.

Fluidic Seed Classifier

Purpose: Separates immature seed, dust and chaff from the good seed.

Specifications:

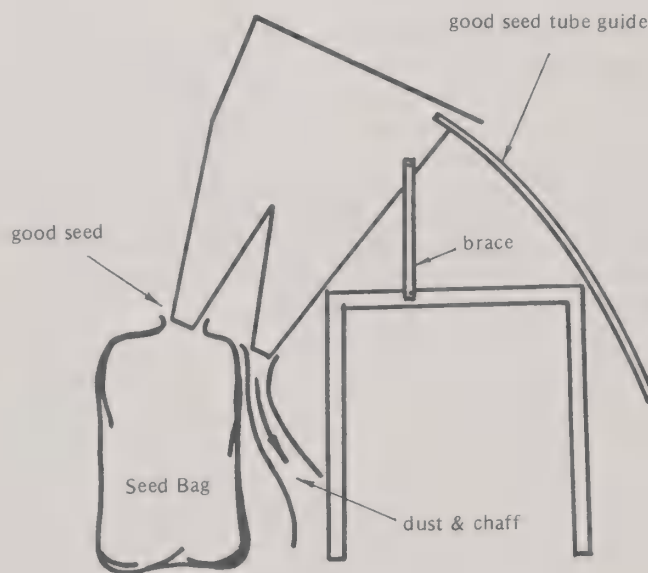
Weight: approximately 100 pounds

Dimensions: 64 inches x 33 inches x 71 inches

Fabrication: Aluminum with steel frame

Power requirements: Air Compressor
(1 cleaner w/1 classifier: 30-40 cfm)
(3 cleaners w/1 classifier: 125 plus cfm)

Lubrication: none



Fluidic seed classifier.

Garrison Seed & Co., Inc.

Art Stoy, Sales Representative, Garrison Seed & Co., Inc.,
Hereford, Texas 79045

Back in the early 1930's, some farsighted people saw the need to do something about the conservation of our soils and other natural resources that evolve from the soils. In April 1934, the Soil Conservation Service was born. This was almost 54 years ago and the service has done its job well over these many years; however, like a lot of other good causes the work is never ending. A number of you in the Soil Conservation Service or Plant Materials Center are doing a good job of selecting and improving varieties that can be identified and certified for use where adapted. Like the improvement of quality and production of any plants, it takes a lot of time, effort, knowledge, and patience to come up with new or improved varieties and I, for one, am thankful that we have people willing to do this kind of work. Usually the monetary awards are not too great, but the satisfaction of a job well done makes the task worthwhile. Certainly there are other organizations that are doing a tremendous service to our country as well. These are both governmental and private. The Society for Range Management would certainly be high on the list in this respect.

I was asked to give an overview of the seed business and to discuss present seed supplies to the CRP programs. In the past 2 or 3 years, there have been plantings of grasses for the sole purpose of producing seed for the CRP programs. It would be hard to estimate exactly how much and what kinds are now in production. With the need for seed as great as it is, I would believe there will be a shortage of most varieties for 1988 seedings.

It seems that Mother Nature knows when to bring about the production for additional acres of grass seed. During the soil bank years of 1956 to 61 or 62 about 28-½ million acres were planted. The seed for those years was mostly harvested from native stands. I was employed by another company during those years. We along with others harvested native Blue grama, Sideoats, Little and Big Bluestem, Indian, Sand Bluestem, Western, Crested, and Intermediate Wheat grasses, Sand Dropseed, Love grasses, and anything else we could find to be used in that program.

In both 1985 and 1987, there was enough rainfall in many areas at the right time to cause the production of many native grass seeds. This has been especially true of Blue grama, Sideoats grama, and the Bluestems (both native and old world). Had it not been for native harvested seed, the CRP plantings could not have progressed at anywhere near the rate that has been accomplished thus far.

In addition to the native and domestic harvests of 1986 and 1987, there was quite a stock pile of certain grass seeds that had accumulated in the several years preceding the advent of the CRP program. As a result of this stock pile and a good many lean agricultural years (economically), the grass seed prices were extremely low, selling at or below cost in many instances. But with the sudden demands on the industry, this soon changed and the prices sky-rocketed with the demand. Also, in all the confusion of getting supplies together, many new names and faces began to show up in the seed business. These people added greatly to the supply of seed, but also to the confusion.

To sum up what I have said thus far, I think we will be able as an industry to supply much of the demand for seed needed in the CRP program for 1988. (Perhaps nearly all). This will require, however, some variation from the normal or desired mixes. Substitutions will have to be made, such as perhaps cutting back on Blue grama and adding more Sideoats, or whatever the case might be in a given area. There will also be delays in having available the kind of seed needed. Testing is a problem. Cleaning, bagging, and mixing take a lot of time. But, all working together will finally bring success in most instances.

Now I would like to address another problem that is, I believe, on the minds of many of us who have made a career of the seed business. There really are very, very few who have been involved in the production and marketing of the kinds of grass seeds that are being used in the CRP. We could not have possibly supplied the needs of this program in the timeframe allotted for carrying out this program. So we

needed advance notice or more help or both to be ready. Fortunately, as I stated above, we were blessed with some extra rainfall at the right time to produce seed on thousands of acres of range land that could be harvested, and many people got into the act. In many instances machines were operating on lands that had few if any seed heads showing. Other fields had heads of grass showing, but were being harvested long before mature caryopses were present, sometimes even in the bloom stage.

There was utter disregard for quality and one would have to assume much of this product was used without proper conditioning or testing. Also in acquiring and planting cover crop seeds, there was very little attempt made to condition or test the seed, to make any determination about weed seed count, or any other quality determination, except when the seed was purchased from various old line seed companies.

Two factors are involved, as I see the situation, with those who have recently entered the seed business. First of all, the demand by the CRP for seed is great, creating a supply and demand that has temporarily escalated prices to a very high level. These newcomers to the business have helped to make it even higher. Secondly, the agencies involved in seed law enforcement have not been able to keep pace with the increase in demand for their services. As a result, it is doubtful that any of these new people in the industry have been subject to any amount of policing, if any at all. This creates an unfair seed law enforcement situation as I see it and something needs to be done to provide fairer enforcement of the seed laws, both federal and state. Everyone involved in the process of accumulating and marketing of seed for the CRP (or any other program) should have to operate under the same set of rules. This makes for unfair competition to say the least.

It behooves all of us to try to get the highest quality seed possible to plant on these acres. This is especially true on land that might be expected to become permanent grassland, even after the 10 years required by the program.

Impact of CRP on the Seed Industry

Art Armbrust, Representative, Sharp Bros. Seed Co., Healy, Kansas

The impact of the CRP program on the seed industry is very significant. It has had a dramatic impact on the grass seed industry in particular. The program has increased the demand for perennial grass, both warm and cool season, native and introduced, dramatically. With no more than 6 months lead time, this program would have had a significant impact on annual crop seed supplies, but the demand has been for perennials and it takes the seed industry a minimum of 2 years to respond to an increase in demand of this magnitude. The increase in demand for native species used in range seeding has been ten-fold with an estimated need of 70 to 85 million pounds over the 5- to 7-year seeding life of the program.

Yes, prices are up dramatically for many seed products, but there is another law in effect besides the Food and Security Act of 1985, a law of economics that is always there in a free market and a free enterprise system, the law of supply and demand.

There are several reasons that the seed industry is not in a position to handle these large demand increases.

The grass seed industry tries to produce for the market demand. We have had quite stable demand over the past 10 years and only a few organizations have been involved in the controlled multiplication of the new and improved varieties of the warm season chaffy native grasses. There were no economic incentives to increase production. Wild harvests of native grasses are dependent on favorable weather. We have not had good harvests for the past several years so inventories were at historically low levels. Other reasons for the response were that it is a politically conceived program and industry learned long ago not to react until it sees something concrete and properly funded. We have all seen associates fail by "banking" monies in advance on ideas promoted from the Congress and government agencies. It is also a very short-term program in terms of years—5 to 7 years of seeding at best. It takes a minimum of 2 to 3 years for us to "gear up" with new seed production, especially warm season grasses. Growers require long-term contracts as the first 1 to 2 years produce no income and affect cash flow dramatically.

The industry also received poor "reads" from the early signup. Whereas planners wanted 5 million acres from the first signup, they received only 800,000 initially and only 3 million more on the second "panic" signup. We have now increased to 8.9 million acres with the 5.1 million acres bid in the third signup and all appearances are that the fourth signup could double the current acreage.

We still need one to two years in this industry to respond to these kinds of demand. Government employees and people in charge of programs could certainly stabilize their specifications so that we know how to respond. If the agencies continue to change "specs" to satisfy every farmer and rancher we never will get a feel of what is needed and therefore will not be able to furnish the most desirable material that will meet the long-term objectives of this program.

Another factor for early confusion on the part of the industry was that we didn't know the areas of demand. Species and variety requirements and amounts were unknown to us and we weren't sure of the continued funding of the program. I don't believe we have firm funding past the second year at the present time. If people who develop these programs could study them out a bit, be specific on specifications and requirements, and develop dependable funding, you would not see the sharp price fluctuations we are now experiencing.

Our industry would prefer a more stable demand, which results in more stable pricing and less financial strain on us individually and as an industry. Remember, any investments in capital assets, grower contracts, and people must be amortized by the time the program is over, because once these acreages are seeded, the demand and value for our product will drop dramatically. These are economic facts.

In summary, I would like to state that our industry has always responded to whatever needs our farmers and ranchers have, but we need more time in the case of the added acreage created by CRP.

Please don't panic and change specs. It just keeps us on a roller coaster when it comes to growing and harvesting decisions.

We must as an industry have a decent return on our investment and in this case we have only a short time to realize this.

When this program is over, it's over. The seed industry, especially the native grass industry, will do everything we can to meet the requirements of our regular customers as well as the increased requirements of CRP.

We welcome the challenge!

New Caterpillar Tillage Tractor Combines Features of Wheels and Tracks

Bill Reno, Sales Representative, Caterpillar Inc., Peoria, Illinois 61629

Caterpillar and Agriculture

In the late 1800's, Holt & Best were competitors in ag tractor development in California. They produced steam powered tractors and pull-type combines. In 1904, Benjamin Holt, inventor and president of a Caterpillar predecessor, demonstrated the world's first practical track-type tractor. Soon carrying the "Caterpillar" trademark, Holt's track-type machine captured the interest of farmers the world over. Huge areas of new farmland were opened to crop production and the track-type tractor took its place in the evolution of farm mechanization. During these early 1900's John Deere worked closely with Benjamin Holt to supply implements to the ag industry. Holt continued to expand his business into other markets. Track-type tractors were found to be very useful in logging, freight haulage, and basic earthmoving. Caterpillar's destiny was taking a turn. In 1936, Caterpillar sold their combine line and patents to the John Deere Co.

During the late 1930's as track had replaced steel wheels, the rubber tire started to replace track. This was particularly true east of the Rockies. Farmers were intrigued with the mobility and speed, but sacrificed traction and flotation. The domination of the ag industry in Caterpillar business

plans was declining, but agriculture continued to be an important part of Caterpillar's worldwide business. In recent years, almost 10 percent of annual unit sales have gone into agricultural applications. Many of these units were "Special Application" tractors such as the D5 SA and D6 SA, which still perform tillage work west of the Rockies.

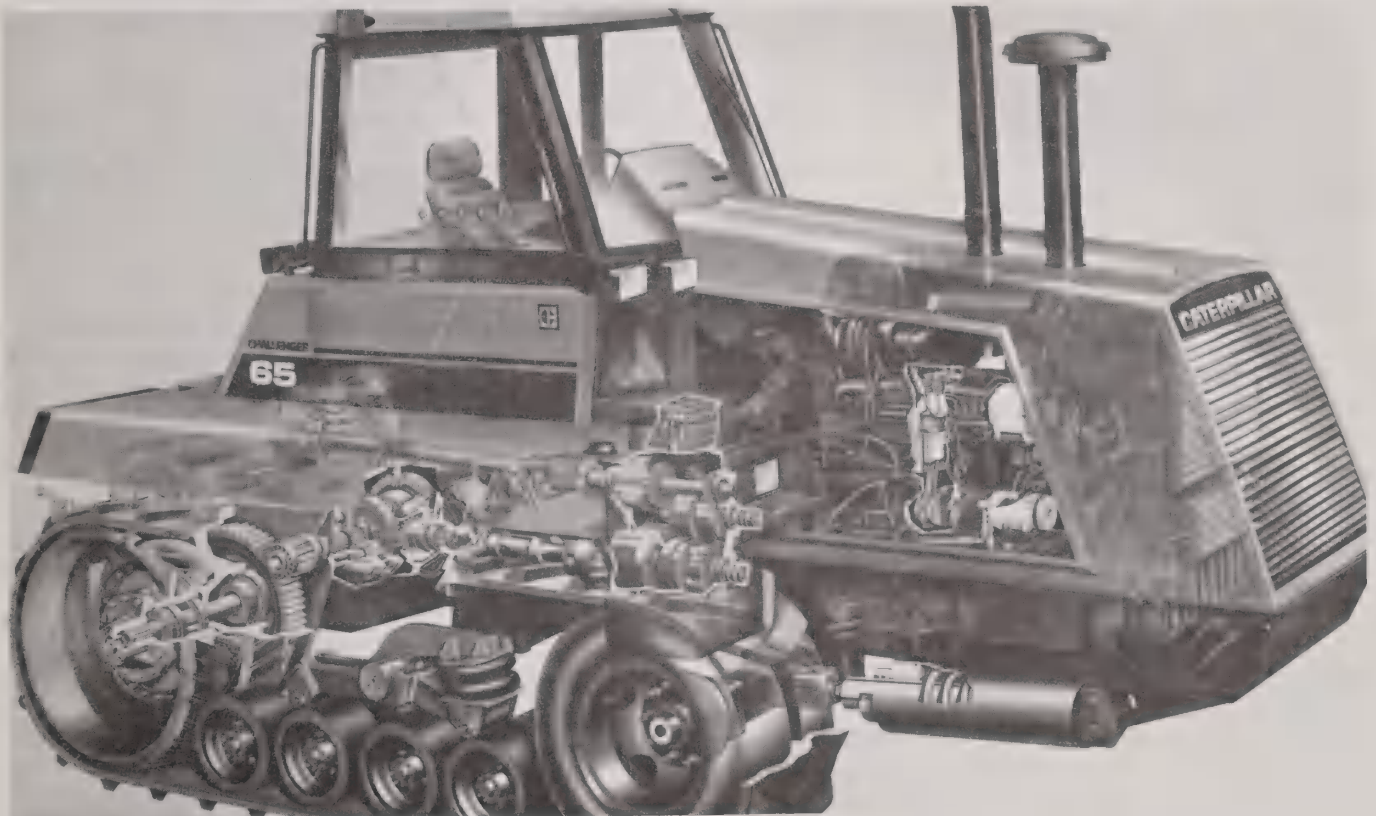
Caterpillar offered improved machines such as the AG6, with better balance, improved hydraulics, and a quieter, more comfortable cab. But this was not enough to win back those farmers who had converted to wheels many years before.

The Challenger 65

Recently, a new era of agricultural emphasis at Caterpillar was ushered in. Caterpillar Inc. introduced the Challenger 65, a 270 gross horsepower all-purpose farm tractor with a unique traction system.

Traction System

The Challenger 65 combines the speed and mobility of wheels with the improved traction and flotation of tracks.



The Challenger 65.

The machine rides on flexible rubber belts, reinforced with continuous strands of steel cable bonded into the rubber. Rubber lugs on each belt provide higher traction than tires on comparable four-wheel drive tractors.

Wheels have always had inherent problems in farm work. They rely on a fairly small ground-contact area to develop traction. If a tractor has too little weight, the wheels slip under working loads. But, if you add weight, compaction increases, that cuts crop yields.

Caterpillar attacked that problem by going to a traction system that spreads the tractor's weight over more area, so it compacts less. At the same time, the broad, rubber belt surface gives better traction than wheels, slipping less.

The two belts are each 24.5 inches wide with a static footprint of 8 feet 10 inches, providing a ground contact area of 5194 square inches. The machine's operating weight of 29,700 pounds distributed over this large area, results in a ground pressure of 5.7 pounds per square inch—under half that of a 4WD tractor on 18.4 x 38 dual tires.

The Challenger 65's top speed is 18 mph; in the range of most rubber-tired tractors. Since the rubber belts are harmless to highway surfaces, the Challenger 65 can be driven at road speeds when required.

The belts also provide better traction and less ground slippage than tires. In our field tests in typical conditions we find that our design transmits close to 15 percent more drawbar power to the tool than a wheeled tractor. And when conditions are soft or spongy, drawbar pull can be 35 percent more.

The Challenger 65 develops top drawbar power at about 4 to 6 percent slip, while a wheeled tractor's peak power is at 15 percent slip. Power loss due to slippage, is reduced by as much as 75 percent at full load with the Challenger, which results in improved fuel economy and longer life for the drive surface.

The Challenger 65's ride is comparable to a wheel tractor. Contributing to the ride improvement is the traction system's bogie-type suspension.

The bogied midwheels are cushioned by air-suspended major bogie, allowing them to flex with ground contours and spread tractor weight over the full belt-to-ground contact area.

More ground contact also plays a role in the Challenger's smoother ride. Ground contact length per side is 106 inches, so the traction system bridges over uneven terrain, like when traveling across furrows or on hard or frozen ground. It doesn't feel every bump like a wheel tractor.

Steering

Steering is by a conventional steering wheel through a differential that varies the relative speed and direction of each rubber belt. Driving force to the belts is continuous; all turns are power turns. Since power to the tracks is never interrupted, the operator maintains complete control for smooth, even turning.

Engine

The Challenger 65 is powered by a 6-cylinder Caterpillar 3306 TA diesel engine, rated at 270 gross HP (256 FWHP), at 2100 rpm. This direct injection, turbocharged and after-cooled engine has been field proven in many other Caterpillar machines. Its large displacement of 638 cubic inches, and a torque rise of 30 percent combine to provide excellent engine response. Sound dampening is provided by a resilient engine mounting that reduces vibration to adjoining components. A large diameter, slow-speed fan and underhood muffler further reduce engine noise.

Transmission

The Challenger's full power shift planetary direct drive transmission has 10 forward speeds from 2.6 to 18.2 mph, two reverse, and a maximum speed of 4.5 mph. Shifting is by a single lever, in a straight line pattern, and can be done on-the-go, without clutching, to meet changing load and speed conditions without losing tractor momentum.

The five speeds in the 4 to 7 mph key tillage range are closely spaced, with no step more than 0.8 mph. For accelerating heavy loads, or close-quarters maneuvering, an inching pedal is provided and can be used in any gear up to seventh speed.

Hydraulics

The tractor has load-sensing hydraulics, powered by a closed-center variable displacement pump. The pump delivers hydraulic flow only when load demand rises above 300 psi, thus reducing drain on engine power when implements aren't being raised or lowered.

Three hydraulic valves are standard; a fourth is optional. A fifth electrically controlled hydraulic valve is available for the optional three-point hitch. Each circuit is equipped with ISO standard quick couplers.

Cab

The Challenger 65 is equipped standard with cab, including a filtered air conditioner and heater, windshield wiper, hinged side and rear windows, tinted safety glass, and AM-FM cassette stereo. The instrument panel has full gauges.

An optional performance monitor provides visual and audible warning of developing problems in critical machine functions. It also monitors such factors as total acreage and acres-per-hour production, distance traveled, fuel remaining and optional PTO rpm. The computer also compares track speed to radar-monitored true ground speed, providing continuous read-out of slip.

Other Options

An optional 3-point hitch is available, adjustable for Category 3 and 3N implements. Automatic latches allow hookups without dismounting.

Hydraulic controls maintain uniform pre-set tool depth, preventing the hitch from rising when tool loads increase. Tool-depth drift is automatically corrected by an electronic controller.

A rear-mounted optional power take-off, controlled from the cab through a transmission-mounted PTO clutch, operates at 1000 rpm at rated engine speed.

Sourcing Seed for CRP

Panel Discussion, Wendall Oaks, Moderator

One of the most important impacts on plant materials the past two years and potentially for years to come is USDA's Conservation Reserve Program, known as CRP. Authorized by the Food Security Act of 1985, the Conservation Reserve Program began in March of 1986—almost two years ago. The goal of the CRP is to remove from production for 10 years highly erodible cropland and reestablish these areas to a permanent cover.

The potential of the CRP is to re-establish to permanent grasses or trees over 40 million acres nationwide. To date over 25 million acres have been accepted for CRP payment. Even a year ago the states of Colorado and Texas had well over 1 million acres already in CRP land.

Progress by States

The following charts show the status of the CRP program through the six signups on February, 19, 1988.

The impact on plant materials and the revegetation industry has been and will continue to be significant. A recent survey of Colorado, New Mexico, and Utah showed a potential

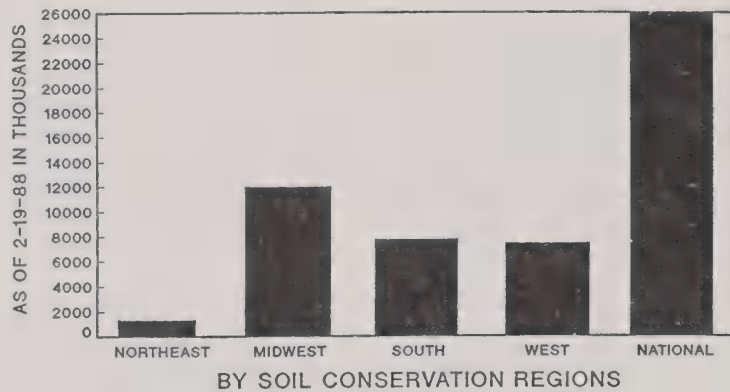
demand for almost 10 million pounds of seed of primary range species would be needed in the next three years. This is undoubtedly a conservative estimate. This in addition to normal seed needs will place tremendous pressure on the seed industry, equipment industry and USDA agencies including ASCS and SCS.

As a follow up to last year's panel on the impacts of the CRP on the seed industry, this year we would like to address the issue of sourcing of seed for CRP—the big issue of which is how do we maintain quality seeds within the confines of the CRP. We would also like an update on the state of the industry.

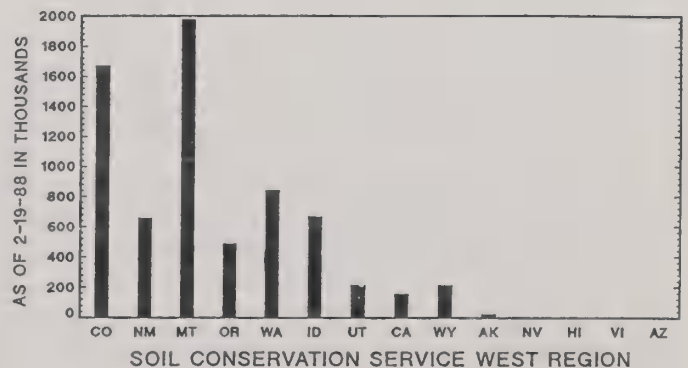
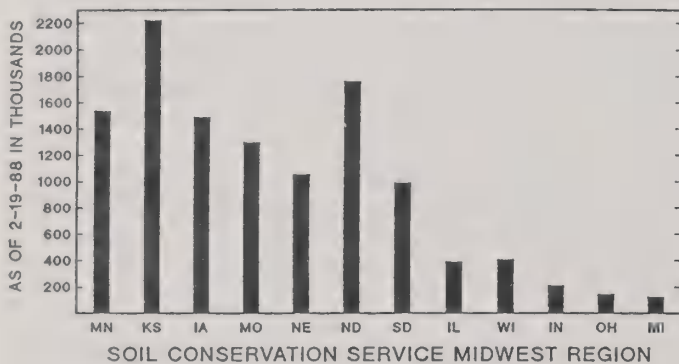
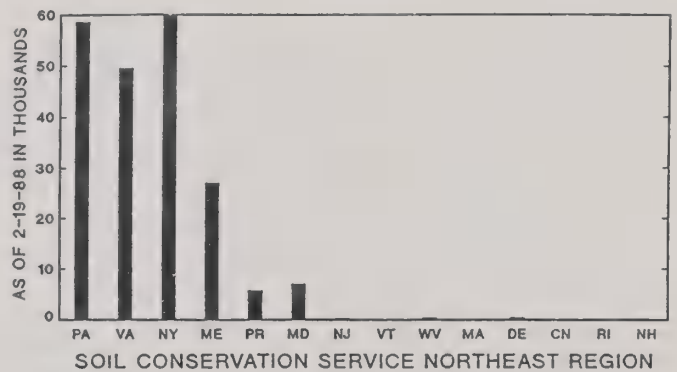
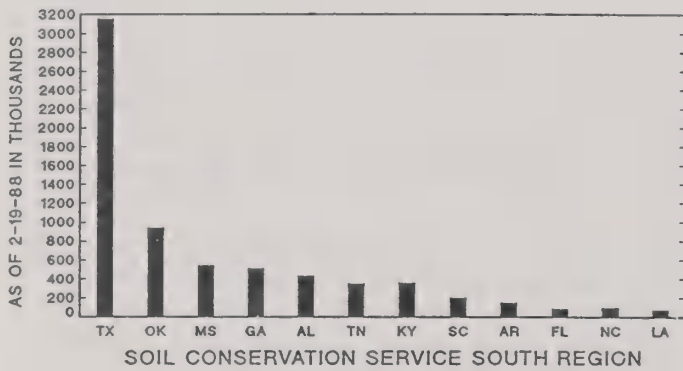
The panelists and the seed industry should be complimented on their resourcefulness and commitment to meeting the needs of the CRP. It has been expensive and frustrating. It should be recognized without their support and commitment the CRP would not be successful.

After introductory remarks, the panelists answered questions. On the following page is a synopsis of some questions and answers.

CONSERVATION RESERVE PROGRAM
CRP ACRES ACCEPTED BY REGION
UP THROUGH SIX SIGNUPS



CONSERVATION RESERVE PROGRAM
CRP ACRES CONTRACTED BY STATES



1. *Question:* What recommendations would the industry have on how do the farm and ranch community including administrative agencies carry out and sustain a quality and affordable seed program given the crisis atmosphere we find ourselves in today?
Answer: Make as few changes in the program guidelines as possible so the industry can respond to needs of the program.
2. *Question:* Should USDA or other interested parties impose more stringent regulations concerning seed quality—i.e., areas of collection, certified seed only, lower weed seed content?
Answer: Where seed is short imposing additional regulations will not help the situation. Education of the consumer is the key to maintaining quality not more government regulations.
3. *Question:* What about cultivated production of improved Plant Materials cultivars versus native harvest—should we be nervous?
Answer: Given availability being equal, of course improved varieties are preferred. However, availability is not equal. A careful buyer can still get some good seed from mature harvests but we must be careful about where seed was harvested and what germination and purity. The bottom line is that for this year some buyers may have no choice although these situations should be limited.
4. *Question:* What are some long term and short term impacts of CRP on the availability of certified seed?
Answer: In the short term seed will be short. The law of supply and demand will result in more seed being available within 1 year. As long as seed is in short demand certified seed will be limited because growers will be able to sell seed without worrying about certification.
5. *Question:* What should established seed buyers do to guarantee seed availability?
Answer: Most seed dealers are interested in having seed for their regular customers. However, they cannot afford to lose profits by selling seed below market prices or at special rates to some customers. Other businesses couldn't afford to do that and stay in business and seed dealers are no exception.
6. *Question:* What changes might we expect to see in the next few years in seed availability, seed prices, seed quality as we move into later stages of the CRP?
Answer: Seed prices will go down and availability will go up. The law of supply and demand applies as well to the seed industry as well as to any other manufacturing industries.

Benavides Ranch—Range Improvement in Mexico

Trinidad Benavides, Rancher, Nuevo Laredo, Tamaulipas, Mexico

When we began working our ranches, we had a cow-calf operation and a continuous grazing system. We began to notice that we were losing our best grasses, forbs and bushes year by year and Mother Nature was replacing them with undesirable weeds and brush that drastically lowered the carrying capacity for beef-cattle. We decided to begin a vegetative rehabilitation program using the best introduced grass species. We started in 1972 by establishing common buffel pastures mainly in areas that could be irrigated along the shores of the Salado River where our ranches are located. This decision led us to look for the quickest return of our investment. That was the Buffel grass seed production and enough stacks to take advantage of the forage quickly and to be ready for another seed crop. In order to improve this business we tried several ways of harvesting the seed. We began by hiring people to harvest the seed directly by hand; then we used various harvesting machines until we developed our own roughly designed seed harvester. It gave us excellent results. It consists of an old and cheap pick-up reinforced to cover 25 acres of rough terrain daily. The front part of the pick-up holds a rectangular box whose frames are made of iron pipe; its floor is made of a sheet of metal. The ceiling and the rear are covered with mosquito wire so that the air can pass through it and the seed stays inside of it. The front side is covered with half an inch net wire in such a way that when seeds are struck only the ripe ones separate from the ear. The lateral sides are doors that open when the box is full of seed, so seed can be put in sacks and taken to warehouses where it can be emptied and left to be dried by air. When the seed is completely dry, it is placed in sacks and is taken to moisture-free buildings to keep its quality and enhance germination.

This program of Buffel Grass Seed production has led us to become one of the most important seed producers in Mexico. The amount of seed produced annually fluctuates between 60 and 90 metric tons.

Another important goal for us was to look for the best grass varieties adapted to our region. In our search we tried NK 37 Bermuda Grass, Kleingrass-75, Blue panic, and others; but the best ones for us have been Nueces, Llano Buffel, and Pretoria 90 bluestem. We have found that cattle, horses, and even wildlife prefer Pretoria 90. It is adapted to saline and heavy soils and swampy areas; but it also has drought resistance.

In 1976 we began to rehabilitate brush country in order to support more cattle. We cleared a large 2,000 acre block by using a root plow rake, land plane, etc. We established common buffel and we increased the carrying capacity for cattle at an important rate, but we found that we had destroyed a wildlife habitat. Deer began migrating to the buffel grass in the evening to get back to the brush early in the morning because of the lack of cover. Then we decided not to do any type of brush control on big blocks, to rebuild the habitat, and to give the protection required by wildlife. It took us 8 years to achieve that goal and the massive deer migration disappeared.

In 1983 on this same ranch, we started a project to make a cell grazing system. Our goal was to reach 32 paddocks in four different cells. We had to stop at seventeen paddocks because the carrying capacity was so high that the money we had to build more fences was used to buy more cattle to harvest the over supply of grass.

The main problem was water. We didn't have underground water so we had to make a big concrete storage tank in the highest spot of the ranch with a capacity that enabled us to assure the maximum water consumption that the ranch might need and to have a twenty-day reserve to solve any problem that might occur. The water that we are using in the concrete reservoir is supplied by two stock tanks using two windmills.

One of the windmills is a number 12 aermotor with 2-inch cylinder and a graphite seal on top in order to lift the water to the concrete reservoir by a 2-inch PVC, 100 psi, pipe that is one and one-half miles away. The other windmill is a number 14 aermotor using a 3-inch cylinder and a graphite seal to pump water to the same concrete reservoir using the same kind of PVC. But, this stock tank is more than 2 miles away and when the wind was blowing hard we had problems with broken PVC pipes because of too much pressure. This problem was solved by using an air pressure tank. In a little bit over 4 years, running 1350 head of stock, we haven't had any problems with water. From this water reservoir 2-inch PVC pipe lines carry water to the four cell centers by gravity and in each cell center we have a 20-foot diameter water trough with a concrete side walk around it.

Another problem was that we had to build many long fences. We decided to solve the problem with electric fences using 3 high tensile wire lines. We placed the wooden posts 120 feet apart and the pulls are placed at a distance of 3,000 feet. We found that for the cost of each mile of conventional barbed wire fence, we could build 3 miles of electric fence faster and using less labor. The wooden posts are mainly mesquite and huizache that are peeled and placed in diesel for several days. Then we put the part that is going to be underground in boiling asphalt. That way we achieve a life span of over 30 years.

This grazing system rehabilitates and fortifies the most nutritious and palatable grasses, forbs, weeds and brush by using the cattle as the best tool to prune desirable species in certain parts of the ranch and allows the same cattle and wildlife to seed the desirable plants over the whole ranch.

The important fact about this rotation method is that the cattle graze according to the growth of the forage in such a way that they consume a maximum of 40 percent. They are moved before the 4 days required for the first buds and are not returned until the vegetation has bloomed again, which assures us maximum weight gains on the cattle because of the high quality forage. Another important aspect is that this method allows us to control the carrying capacity and make adjustments to increase the flexibility based on the stocking rate we have, the percentage of the forage used by the cattle in each paddock, the number of paddocks still unused, and the way in which the forage is recovering in the paddocks already grazed.

In our experience we have found several advantages using this rotation grazing method. The most important are:

1. Inventory control. As a rule, we move the cattle every 2 or 3 days from one paddock to another. We count and register the number of cattle and when an animal is missing we have to find it dead or alive. Because the paddocks are so small, it is very easy to look for an animal either in that same paddock or in a neighboring one.

2. Observe sick or injured animals. Poor-doers can be taken to pens in order to give them the required treatment or to sell them.

3. Tame the cattle. Continuously moving the cattle causes them to lose their fear of people. They never get nervous again.

4. Fertilization of range. Because all the cattle graze in one herd in a small paddock they urinate and defecate and improve the soil fertility everywhere in the paddock.

5. Herd effect. Because all the cattle walk together, their hoofs break the hard coat of the soil and help the penetration of humidity.

6. Fortify the best forage species. When the cattle eat the best species at the adequate stocking rate, we obtain the desirable buds for wildlife and increase root reserves.

7. Increases the carrying capacity. We have seen that the carrying capacity has increased for wildlife and cattle. Each year we have more population of our best forage, bundle flower and four wing saltbush, that cattle and wildlife have been seeding or spreading in a very impressive way.

8. Increases flexibility of the ranch. I want to add that the more varieties of grasses, forbs and weeds that a range has, the better alternatives for a balanced nutrition all year round. Some vegetation appears when it rains in spring; others when it rains in winter, but if we don't have them at the ranch we will have to seed those that help us to survive the long droughts or the hard winters. In this region the main species we have for that time are prickly pear and salt bush. The prickly pear is the cheapest and most important energy source and the four wing salt bush is the most important source of the protein that the cattle and wildlife utilize in hard times. Other species that are also useful to us are: popotillo, cenizo and guayacan; all are evergreens.



Grazing cattle on Benavides Ranch.

But in order to have profitable ranching, we have to talk about the total management of the ranch. The best alternative is to obtain a multiple-use of the forage resources that enables us to reach the optimum carrying capacity of cattle and wildlife. This includes managing these resources with hunting leases for deer, quail, javalina, etc., as well as migratory birds such as white wing dove, Canadian geese, ducks, pelicans, etc., utilizing sport bass fishing if we have adequate lakes or dams; and having the best habitat for domestic cattle and wildlife. We are using a root plow to seed strips of rangeland to increase the carrying capacity for cattle and wildlife simultaneously.

Besides establishing grasses we are planning to plant prickly pear and four wing salt bush in each paddock in such a way that if there is a drought the rotation program will not stop.

In one of our ranches we are going to try to seed Pretoria 90 and Blue Stem; Nueces Buffel in other areas; and common buffel in the rest of them. This present year, after burning prickly pear direct in the brush, we are going to hand seed it by taking advantage of the soil disturbance caused by hoof action, the urine, and the defecation of the cattle.

For next winter we want to try the use of fire in little portions trying to see if we can avoid the use of butane to burn the prickly pear and still have enough grass to abundantly feed the cattle. We know that we will have to supplement chicken litter and wheat bran for complete nutrition and to avoid the accumulation of fiber in the rumen.

This year we began to use the fire in certain areas of the ranch and according to the results we have, this method could be the most economic way to rehabilitate vegetation and control bad weeds. Planning specific areas where we are going to use the fire each year will help us reach our desired goals.

Another important thing that I want to tell you is that we, the cattlemen of Mexico, feel that the most important improvement was achieved on May 16, 1987 when the National Cattlemen Confederation constituted an association for the management, conservation, and profit of wildlife. The National Association of Diversified Cattlemen was established with the consent of the National Department of Agriculture in coordination with the Ecology Department. It was a result of more than 3 years of continuous effort of a little group of cattlemen from Tamaulipas, Nuevo Leon, and Coahuila headed by my youngest brother, Ing. Joel Benavides G., who was elected as the first president of this new association.

In order to give a small explanation of the way the cattlemen organization works in Mexico, I will tell you that there is a national organization called National Cattlemen Confederation. This organization is represented with two delegates from each state's cattlemen union and some states have two unions. They are also represented with two delegates from each one of the 14 specialized associations like—pig raisers, chicken raisers, dairy raisers, and the raisers of each one of the registered races of cattle and horses. Within these 14 specialized associations is also included this newborn association of diversified cattlemen. The State Unions are represented with one delegate from each local cattlemen's association of each county, and these local associations are the foundations of the whole organization. Through them, each cattleman receives the benefits that help him to fulfill all his obligations or duties. The specialized associations have members all over the country and state delegations to facilitate its management.

This cattlemen's organization is ruled by the law of the Cattlemen Association of the Agriculture Department. The local Cattlemen Associations have elections every year. The State Cattlemen Unions and the specialized associations have elections every 2 years and the National Cattlemen Confederation has elections every 3 years.

This organization allows us to enjoy special benefits from contributions or income taxes. It also gives us the exportation permits for steers and the permits to import registered cattle. Besides, it is responsible for such national campaigns as the one against screw worm of the cattle and all other sanitary campaigns.

As you can see, in Mexico every branch of the animal country production is dependent on the cattlemen's organizations. Wildlife was not included in these associations which is one of the main reasons why we have lost almost 85 percent of wildlife in our country. But we are sure that if we, the cattlemen, are conscious that we are the managers of the wildlife habitat and if we receive encouragement from the government and the incentive of increasing our legal incomes, we will begin to repopulate wildlife all over our country.

Finally I want to tell you that everything we could do to rehabilitate vegetation, improve the quality of the range, and provide a better habitat in order to obtain a harmonious way of life of all domestic and wildlife creatures is to fortify our spirit and to have a place to be in peace and to teach our children to feel the presence of our Lord, because by so doing we please God and give Him a small bit of the many blessings that we have always received from Him.

Arid Land Seeding

Harold T. Wiedemann, Chairman, Texas Agricultural Experiment Station, Vernon, Texas

The committee encouraged testing and evaluation of the disk-chain by various agencies. Both design and seeding research look very promising. Summaries of this work are presented separately.

Greenstripping: A Proposal to Reduce Wildfires in Southern Idaho

Mike Pellant, Bureau of Land Management, Idaho State Office, Boise, Idaho

In recent years the incidence and size of wildfires in southern Idaho has increased. This phenomenon is especially evident in the Bureau of Land Management's (BLM) Boise District, where a record acreage of 391,000 acres was burned in 1986. Besides the high costs to suppress fires and rehabilitate burned areas, there are adverse impacts to a wide variety of resource values.

Impacts of Wildfires

In the foothills north of Boise, watershed stability is reduced after steep, erodible slopes are left exposed by wildfires. In addition to the loss of on-site soil productivity, deposition of soil sediment off-site can cause economic and biological impacts to both public and private lands. Some riparian areas are changed from clear flowing streams to silt laden gullies. Shrubs and trees are burned and often exhibit slow recovery, which causes important fisheries values to decline.

These lower elevational ranges also support large populations of wintering mule deer. In 1986, 65,000 acres of critical deer habitat were lost in a 5-day period when numerous wildfires were started by lightning. About 50 percent of the 6,000 deer that use this area were harvested in a special hunt to minimize impacts to unburned habitat and nearby farms and orchards.

The Boise District also contains the largest concentrations of nesting raptors in North America. Over 50 percent of the 480,000 acre Snake River Birds of Prey Area has been burned within the past 10 years. Loss of shrub cover reduces prey habitat and affects raptor productivity. Wildfires are the greatest management concern in this unique raptor ecosystem.

Livestock grazing is an important use of the public lands in the Boise District with 111,000 cattle and 78,000 sheep licensed annually. Loss of livestock forage by wildfires on public lands forces livestock permittees to seek alternate and more expensive forage sources, and results in loss of income to the government.

Private property losses are rising with the increasing wildfire incidence in the Boise District. Suburbs in both Mountain Home and Boise, Idaho, were threatened by wildfires in 1986. Agricultural fields and historic structures have been destroyed by wildfires, resulting in economic losses to property owners.

Greenstripping Strategy

Idaho BLM has initiated a fire presuppression program, greenstripping, to reduce the increasing economic and resource losses caused by wildfires. Strips of fire-resistant vegetation are placed at strategic locations to reduce the size and frequency of wildfires. Greenstrips have been established along highways and railroads and between annual rangelands and native shrublands.

Greenstrips will slow down the spread of or stop wildfires before they reach catastrophic size. Plant materials used in greenstrips retard the spread of wildfires because the strips stay green longer than annual vegetation and reduce the amount of fine fuels (annual species).

Greenstrip Projects Completed to Date

The first greenstrip project in the Boise District was completed in 1984 with the seeding of a 3-mile by 300-foot wide greenstrip adjacent to Interstate 84 near Mountain Home, Idaho. No seedbed preparation was done before drilling Fairway crested wheatgrass in a burned cheatgrass stand.

In 1985 a road grader removed cheatgrass seed from the seedbed before seeding a 6.5-mile greenstrip in the Mountain Home area. The top 1 inch of soil was "stripped" from a 30-foot wide area before drill seeding. Three wheatgrass species (Nordan and Fairway crested wheatgrass and Siberian wheatgrass) were seeded in adjacent 10-foot wide rows to determine establishment characteristics.



One-year-old greenstrip where road grader was used to prepare seedbed.

On another 1985 project, a towner plow prepared the seedbed for a 14-mile greenstrip north of Grasmere, Idaho. Adjacent strips of Ephraim and Nordan crested wheatgrass were drill seeded behind the plow. Greenstrip width was 90 feet.

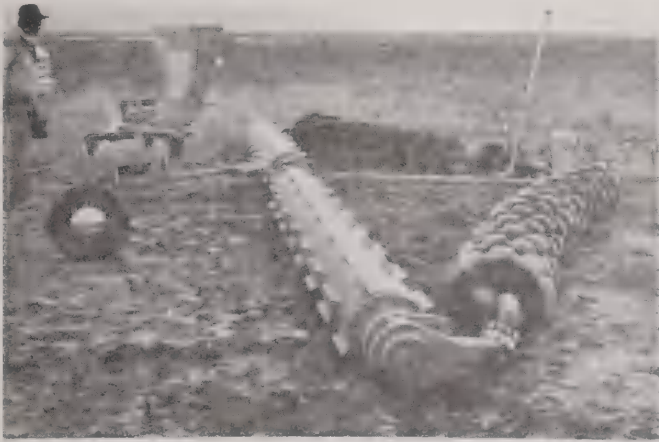


Towner plow used for seedbed preparation prior to drill seeding.

A disk chain was first used in March of 1986 to prepare the seedbed on an 8-mile by 30-foot wide greenstrip south of Boise, Idaho. This early model of the disk chain had two broadcast seeders mounted on the back of the bulldozer pulling the disk chain. Broadcasting seed with this setup proved difficult in the windy conditions common to this area; therefore a rangeland drill was used to seed the greenstrip.

The majority of greenstrips installed in 1986 were done with a towner plow/rangeland drill combination. Almost 40 miles of 300- to 600-foot wide greenstrips were seeded with mixtures that included crested and Siberian wheatgrass, Russian wildrye, and yellow sweetclover. On silty soils near the Snake River, a cultipacker was used to firm the plowed seedbed before drill seeding.

A modified version of the disk chain seeded 6 miles of greenstrips southwest of Mountain Home in the fall of 1986. Various seed mixtures were tried including Hycrest crested wheatgrass and forage kochia (*Kochia prostrata*). Strong winds again affected seed dispersal even though the broadcast seeders were mounted on a trailer immediately behind the disk chain. Also maintaining equal calibration of the two seeders was difficult especially in rough terrain.



Modified disk chain used to seed greenstrip in burned cheatgrass stand.

Equipment Evaluation

Disk Chain—The disk chain shows the most promise of the three types of equipment used in the Boise District greenstripping program. It requires only one pass to prepare and firm the seedbed before seeding. Earlier problems with seed dispersal and replacing broken disks are being corrected on a modified disk chain being constructed by the Missoula Technology and Development Center in Missoula, Montana, and Boise District, BLM. A frame will be constructed so seed boxes can be mounted over the roller bar. Greater flexibility in handling diverse seed mixtures will be provided as legume, grass and trashy seed boxes will be installed on the new version.

Disk breakage was a problem on earlier disk chains, especially when they were used in rocky areas. This problem will persist on the new version, however disk replacement will be easier as each disk will be bolted to the chain with a bushing. This is an improvement over past versions where disks were welded directly to the chain and required cutting off broken disks and welding replacements back on.

Costs of using the disk chain are hard to estimate because of the limited amount of use. Maintenance costs of replacing broken disks and worn out bearings are unknown at this time. Excluding maintenance costs, we feel operation costs should be reasonable, since the disk chain will be pulled only once over the same piece of ground and will cover 20 to 30 feet of ground on each pass.

Towner Plow—The towner plow proved to be a durable and effective piece of equipment to reduce cheatgrass competition before seeding. Some spare parts are no longer available, which makes maintenance difficult and expensive. The towner plow could be used in rocky areas with minimal disk breakage. However, the seedbed left by the towner plow was loose and rough, even with correct depth adjustment of the disks. This seedbed is not conducive to good seed germination unless climatic conditions are ideal.

Costs to operate and maintain the towner plow on 40 miles (2,000 acres) of greenstrips were estimated at \$20 per acre. This figure does not include subsequent drill seeding or seed costs.

Road Grader—A road grader was used effectively on one greenstrip project. For a road grader to properly prepare the seedbed, soils must be free of large rocks and terrain must be relatively level. Care must be taken to insure that litter residue and loose soil are bladed off the seedbed. This technique would not be effective on wide greenstrips (50+ feet) due to the number of passes that would be required to remove all loose soil and litter. However, this technique leaves a firm seedbed and creates an ideal seedbed for drill seeding.

Plant Materials

It is too early to fully evaluate the performance of the plant materials used in the Boise District greenstrips. Plant materials used in greenstrips are selected for the following characteristics: (1) Fire-resistance—they should stay green longer than surrounding vegetation; (2) Ability to establish and compete with cheatgrass; (3) Ability to resprout after a fire; (4) Palatability to wildlife and/or livestock to meet multiple use objectives and to minimize litter (fuel) accumulations.

Most of the recognized varieties of crested wheatgrass have been utilized in the 90 miles of greenstrips established in the Boise District. Since only two growing seasons have passed since most greenstrips have been installed, it would be premature to recommend one crested wheatgrass variety over another. A preliminary evaluation of species establishment and cheatgrass reduction was completed in the summer of 1987. Results from this evaluation will be presented at the 1988 Society for Range Management meeting in Corpus Christi, Texas.

Forage kochia establishment and growth in several greenstrips has been noteworthy. Containerized seedlings planted in the spring of 1986 matured and produced seed by the end of the first growing season. New seedlings established near the mother plants during the second growing season even with a spring drought. Forage kochia stayed green during both growing seasons.

Summary

Greenstripping will not eliminate wildfires in southern Idaho. However, once wildfire frequency and size are reduced, additional habitat restoration with shrubs can be completed. Ultimately, the restoration of 2 million acres of cheatgrass rangelands administered by BLM in southern Idaho may be possible. Along the way, fire suppression and rehabilitation costs may be reduced by as much as \$1 million annually and valuable forage, habitat and watershed values can be protected from the ravages of wildfires.

There are many unknowns in this effort. Only a small number of the potentially useful plant materials has been utilized in greenstrips. Equipment modifications and development could improve greenstrip establishment. Wildfires will still occur, therefore development of palatable shrubs capable of resprouting after fires is desired.

Idaho BLM recognizes the need for additional work in these areas and is proposing a 5-year research and development project to implement this strategy. This project, called the "Intermountain Greenstripping Research Project", will be a cooperative effort involving various federal and state agencies, universities, and interest groups, all contributing to the development of greenstripping and shrub restoration practices. Results from this project will have direct application to the states of Idaho, Utah, Nevada, and Oregon. If funding is approved, this project will be initiated in the fall of 1987.

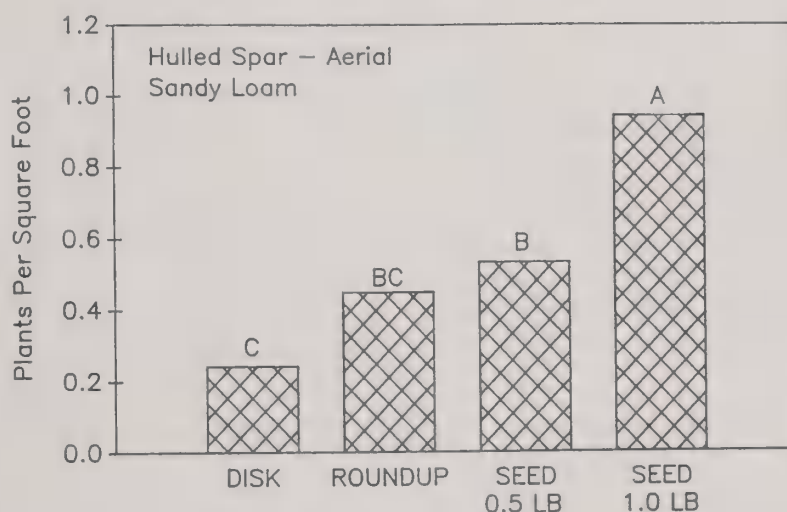
Seeding Using the Disk-chain and Forage Nurse Crops

B.T. Cross, Texas Agricultural Experiment Station, Vernon, Texas

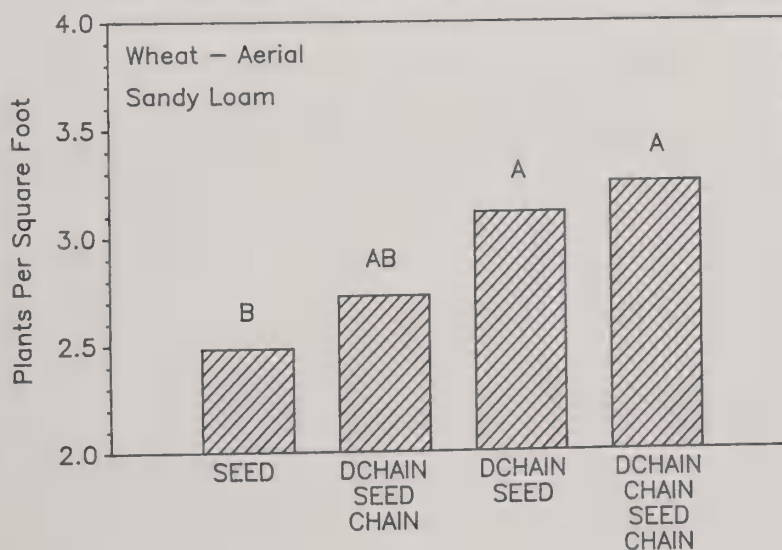
Successful establishment of stands of perennial grasses on semiarid rootplowed rangeland following aerial seeding is difficult because of the effect of erratic rainfall patterns. It was hypothesized that the detrimental effects of limited rainfall events could be buffered by seeding into a cool season cover crop (wheat) during the grazing season. Our underlying hypothesis was that the cover crop, in combination with the trampling effect of cattle, would enhance seedling establishment of the aerially seeded perennial

grasses by firming the seedbed and improving the seed/soil interface. Disk-chaining has been a feasible method for seedbed preparation on log-littered rangeland. Tests using various disk-chaining and aerial seeding combinations achieved good to excellent stands of wheat ($>2\text{plts/ft}^2$) on debris-littered land. Hulled WW Spar bluestem, a warm season grass, was aerially seeded ($\frac{1}{2}$ or 1 lb PLS/ac) into grazed stands of wheat. Study results indicate the concept is feasible. Further information is available from the author.

GRASS SEEDBED – WHEAT/GRASS CYCLE 1986-1987



WHEAT SEEDBEDS – WHEAT/GRASS CYCLE 1986-1987



The Impact of the Conservation Reserve Program on the Farm Equipment Industry

John M. Tye, The Tye Company, Lockney, TX 79241

I have been asked to spend a few moments this afternoon discussing the impact of the Conservation Reserve Program (CRP) on the farm equipment industry. Much as you might suspect, the impact has been dramatic but varied.

Since the farm equipment industry in the U.S. has been generally in a depression for the last 4 to 6 years, any impact from a new or outside program, no matter how slight, is very noticeable.

First, the impact of CRP varies by area. Jim Newman's slides graphically show that area variance. In the northeast and in the far southwest, CRP has had very little impact on farm equipment.

Areas where there has been a minor impact on the farm equipment industry include the pacific northwest where much of the conservation reserve acreage, while not large, has been able to have the cover requirements taken care of by relatively easy to plant wheatgrasses and, to some extent, trees. The same is generally true in the southeast where trees, clovers, brome, fescue, and other grasses that have always been a part of the cropping systems of the area are being utilized. There are no significant requirements for new equipment to handle the seed production, planting, or crop care portions of the cycle.

In the corn and soybean belt of the midwest, there has also been small impact. The small amount of CRP acreage again can have the cover crop requirements satisfied by cropping practices, which are a part of the everyday cultural practices. However, indications are that the next signup of CRP will be focused on the cornbelt area to gain greater acres there one way or the other. An example is the proposed bonus signup for corn farmers in the CRP signup beginning February 9.

The area of greatest impact has been an area we might loosely refer to as the Plains states. In these areas the first signups have taken large volumes of acreage out of production and generated tremendous short-term interest for seed, planting equipment, and some operational know-how.

In looking back at the history of programs designed to take land out of production, there are a number of parallels between the CRP and the soil bank program of the 1950's. The original soil bank program to remove acreage from crop production started in 1956. By 1957 some 27 million acres were diverted, a level that held fairly stable through 1960. During this period the soil bank program and a short lived acreage reserve program accounted for all of the acres diverted from production. Under the soil bank program, farmers were compensated for entering into long-term, that

is 5- to 10-year contracts, to divert land from crop production to soil conserving uses. Acreage enrolled in the soil bank program peaked in 1960 at nearly 29 million acres and then trended downward until the last of the soil bank contracts expired in 1977.

Some of the folks who were actively engaged in farming in the Fifties tell me about the number of parallels between the result of the soil bank program and the announcement of CRP. There were such things as a tremendous increase in demand for seed, and hence seed harvesters, cleaners, storage equipment, etc. There was also a dramatic short-term demand for planting equipment. However, the ground cover required for the soil bank program was generally easy to do with conventional equipment, including such crops as Johnson grass, and sorghum alum. The areas needing hard to plant native grasses, such as side oats and blue gramma, required specialized planting equipment. The Nesbitt grass drill was a familiar sight in the Plains area.

The next significant cropland diversion program was the PIK program of 1983. This program removed a record 78 million acres from production during the 1983 crop year. This particular program devastated farm input suppliers providing everything from farm equipment to seed, chemicals, fertilizer, storage equipment, and other items. Fewer acres required less production machinery and less hours on the production machinery used, which caused waves that are still felt 4 years downstream in the farm equipment manufacturing and marketing business.

The CRP program announced and begun in 1986 will have some of the dramatic short-term effect of the PIK program and some of the long lasting effect of the soil bank program.

The CRP program, unlike the one shot blip of the PIK program of '83, requires a 10-year contract, careful care of the land, and there's the prospect that the land may never be able to be converted back to crop production and qualify for government program payments.

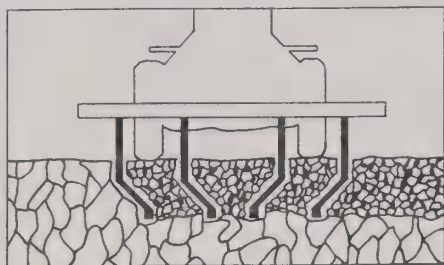
Current projections already call for 65 to 70 million acres to be diverted from production in 1987, mostly as a result of commodity price support programs. CRP is yet to significantly impact those numbers. There are some 70 million acres of "highly erodible" farm land now eligible to enter CRP. In 1986 some 8 to 9 million acres were enrolled, but only 2 million of that acreage was enrolled early enough to affect 1986 crop production. Total enrollment is scheduled to reach about 15 million acres in 1987 and continue to grow to a minimum of 40 million acres by 1990.

The impact of CRP will be not only one of requiring new equipment to produce seed, plant the CRP acreage, and care for it, but also a dramatic reduction in the need for equipment when this land goes out of crop production, perhaps forever.

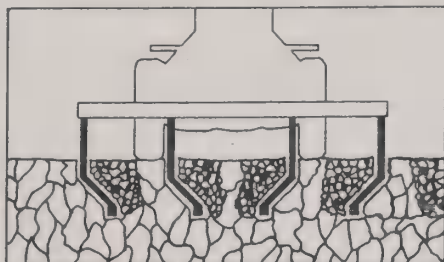
In the short-term there are many impacts.

Currently, there is an immediate demand for cutters, shredders, and mowers to handle cover crop before planting CRP acres. Sprayers will be required to handle weeds in some of the cover crop areas. My friends in the grass seed business tell me there is a very brisk demand for many types of seed, and that's brought on a tremendous burst of activity for the manufacturers of seed harvesting equipment, seed cleaning equipment, and other products along those lines. Some of the equipment manufacturers are so far behind, they can't even see daylight.

There has also been increased interest in drills to plant the native grasses and grass mixtures required for CRP crops. One of the big differences this time around is that each accepted CRP plot must have a specifically formulated and approved plan, generally approved by the SCS office in each county or local district. The requirements make this particular machine different from seed drills utilized by most of these farmers in the past. For example, the seed is different. Some of it won't even start to go through a conventional grain drill. The seed has a critical tolerance for the depth it is planted, and, at the cost of some seed, there's a critical dimension to the planting rates not particularly noticeable before.



Narrow leg spacing (as close as 20", overall loosening).



Wide leg spacing (from 24" to 40"-rows, zone loosening).



Grass drill unit with picker wheel.

Some of us in the planting equipment business have been making grass drills for years. Our grass drill unit with its picker wheel and agitator arrangement was based on some of the work done by Harold Wiedemann of the Texas Agricultural Experiment Station, the Chairman of the VREW Arid Land Seeding Group. However, prior to CRP, sales were generally for specialized applications and unique reclamation efforts.

After CRP, there are some new players in the game, both in the seed equipment end of the business as well as in the planting and harvesting part of the business. However, we're in many cases selling to a new group of buyers—in some cases the land owners, in some cases a custom operator—something that's not been familiar in the planting business before. These buyers need the ability to plant into cover crops, and in many cases they need large machines to cover large acreages in a small period of time.

The user is also finding some new problems he didn't anticipate. Drilling into a cover crop may require that his grass drill be a no-till machine as opposed to conventional. In some cases this past year favorable weather and rainfall generated too much cover crop to plant grass. There's also been the problem of educating farmers and even custom operators on such things as calibration of planting units as well as the peculiar planting techniques of grass seed. And, unfortunately, the farm equipment dealer hasn't been able to help his customer all that much. It's all new to him too. Additionally, faced with the unknowns of how much machinery will be required to accomplish CRP, and even recently if the program will be allowed to run its full course, the dealer is reluctant to invest his time and his money in short-lived expertise or inventory that may become unneeded.

Long-term, the equipment business is still facing a number of question marks. We know that 40 million acres removed from production will make a significant dent in the need for equipment to farm that acreage. We know that many of these CRP acres will remain in grass after the program ends. However, more grassland may mean more cattle-related equipment. At any rate, CRP has had an impact on the equipment business. As I said at the beginning of my remarks, a positive impact for a few and a negative impact for many.

Chaparrosa Ranch—Range Improvements in South Texas

Patrick O. Reardon, Chaparossa Ranch, La Pryor, Texas

The 68,000 acre Chaparrosa Ranch located in the northern part of south Texas is typical of the mixed brush country found in the Rio Grande Plains of Texas. This ranch, along with the 6,000 acre Mangum Ranch south of La Pryor and the 11,000 acre La Puerta Ranch northwest of Corpus Christi, is owned and operated by B.K. Johnson, great-grandson of Captain King, who founded the King Ranch.

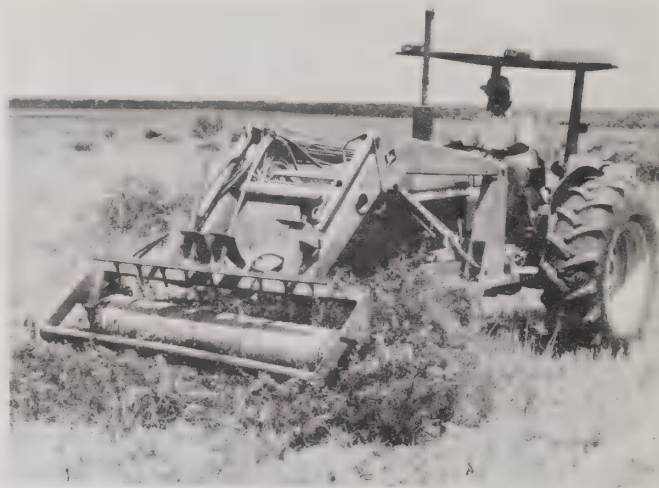
Approximately 10,000 acres of the Chaparrosa Ranch have been cleared and reseeded to Buffel, Kleberg Bluestem, Kleingrass, and other introduced species during the past 30 years. More than twice that much has been aerial sprayed with brush chemicals. Nearly every conceivable range improvement method has been tried and during the years much has been learned.

We have learned that range improvement is not cheap. It is a never-ending battle and it should be followed by good grazing management. Since there are many more dry than wet years in south Texas, we have learned that range improvements should be done as a means of surviving drought rather than increasing your stocking rate. We have also learned that range improvements can and must be designed to improve wildlife habitat, hunter success, and ranch income. Range improvements also include development of food plots for game animals and birds and construction and management of farm ponds for recreational fishing and livestock water.

Ranch profits during the past few years have not allowed us to do much additional land clearing. We have concentrated on renovation of our improved rangeland. Here again, we have tried nearly every conceivable renovation method from root-plowing to individual mechanical and chemical plant treatment. Based on 30 years of trials, the root-plow has proven to be the best brush-clearing tool and the carpet-roller is the best retreatment tool.

After the rangeland is cleared, all our brush species start coming back. In our area twisted acacia (*Acacia tortuosa*) is the hardest to control, primarily because it is a root-sprouter. Use of the carpet-roller with Grazon-PC at .2 pounds active ingredient per gallon of water has given us our most effective and economical control of regrowth brush species. Use of the new product "Reclaim" has given even better results, but the most effective and economical rates have not been worked out yet. If there are more than an average of 200 large brush plants per acre, we have found it more economical to aerial spray or disc with a large Rome disc. Per acre cost using the carpet-roller has ranged from \$5 to \$20, depending on brush concentration and size.

Land cleared and developed for cattle or deer habitat improvement is done in alternating, long, narrow strips to create more "edges". Land developed to be quail habitat is treated with a roller-chopper that leaves motts of selected brush plants 10 to 30 feet in diameter. Both of these methods have proven to be best in improving the habitat and increasing hunter success, which in turn increases ranch profits.



Clearing land with a roller-chopper.

USDA Conservation Reserve Program

Wendall Oaks

USDA Soil Conservation Service, Los Lunas, NM

VREW has for many years, to help fulfill its mission, sponsored special workshops in conjunction with the main VREW program. In February, 1987 one such workshop titled "Plant Materials Workshop—the Influence of the CRP on Range" was held. As a follow-up to this well attended session during the February 88 VREW meeting a panel discussion on "Sourcing Seed for CRP" was sponsored by the Plant Materials Workgroup.

The 1987 Plant Materials workshop consisted of the following presentations centered on the theme "The Influence of CRP on Range."

Introduction. Wendall Oaks, Chairman
Soil Conservation Service, Plant Materials Center,
Los Lunas, NM

CRP Status and Potential Impact on
VREW. Jim Neuman
Soil Conservation Service, Washington D.C.

Seed Industry. Art Armbrust
Sharp Brothers Seed Co., Healy KS

Seed Harvesting Equipment. John Tye
The Type Co., Lockney, TX

Advancement on New Series for Range and
Wildlife. Jack Carlson
Soil Conservation Service, Portland, OR

In 1988 a panel was held on "Sourcing Seed for CRP."
The panel members were:

Art Armbrust	Sharp Bros. Seed Co. Healy, KS
Art Story	Garrison Seed and Grain Co. Hereford, TX
Weldon Miller	Ag. Renewal Woodward, OK

One of the most important impacts on plant materials began last year following the passage of the Food Security Act of 1985 which authorized the USDA's Conservation Reserve Program, known as CRP. The goal of CRP is to remove from production for 10 years highly erodible cropland and reestablish areas to a permanent cover of grass, forbs, shrubs, or trees.

No program in over a decade promises to have such a widespread effect on plant materials and range programs.

Conservation Reserve Program (CRP)

Jim Neuman,
SCS, Washington D.C.

How We Got Started

The Food Security Act of 1985, authorizing the Conservation Reserve Program (CRP), was signed by the President on December 23, 1985. Responding to the Secretary's request to have the program operational within 60 days, a joint Department of Agriculture training session was conducted during the week of February 10, 1986 in Fort Worth, Texas. CRP interim rules were published March 13, 1986. The first signup was conducted March 3-14, 1986 followed by other signups in May 5-16, 1986 and August 4-15, 1986.

Remarkable Progress to Date

The Secretary tentatively accepted 68,951 bids from farmers during these three signup periods to convert 8.8 million acres of highly erodible cropland to grass, trees, or wildlife cover.

This means that 22 percent of a 40 million-acre program has been reached during the initial year of program implementation.

A total of 582,512 acres has been accepted for trees. This represents 6.5 percent of the total acres accepted, short of the legislative goal of 12.5 percent.

Size of CRP Contracts

The average acres per CRP contract varies greatly as follows:

Geographic Area	Average Acres Per CRP Contract
National	128
SCS Northeast National Technical Center	34
SCS Midwest National Technical Center	87
SCS South National Technical Center	109
SCS West National Technical Center	369

If these averages continue about 445,000 CRP contracts will have been signed when 40 million acres are enrolled in the CRP.

Program Cost

The average rental rate per acre is \$45.60 for the acres accepted to date. The bid pool annual rental rates vary from \$20 to \$90.

The contracts accepted to date have obligated over \$400 million for annual rental payments and over \$4 billion for the 10-year life of the contracts. Bases, quotas, and allotments on farms participating in the CRP have been decreased by about 5.7 million acres. This will decrease direct outlays for deficiency payments and paid diversions and indirect outlays for storage, loans, etc., that would have been made to program participants under the annual commodity programs. The net cost of the CRP depends on many variables including the market price of commodities, program participation, and level of production. Considering both the direct and indirect commodity program savings, the CRP is approaching a no net cost status.

Erosion Reduction

When cover is established on land covered by CRP contracts, erosion will be reduced by an estimated average annual rate of 27 tons per acre.

Where to From Here

Additional Signups

The Secretary plans to announce another signup period early in 1987. An additional 6 million acres of highly erodible land is needed to meet the legislated goal of a minimum of 15 million acres enrolled by the end of the 1987 crop year.

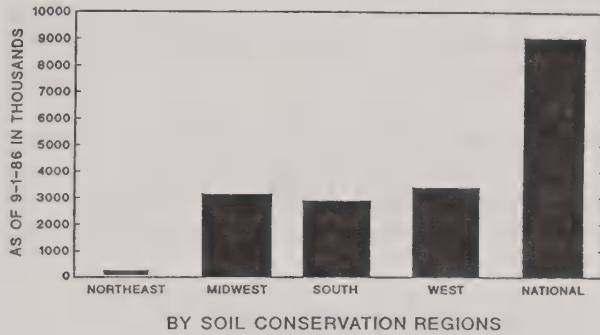
Finalize CRP Rules

The CRP final rules are expected to be published early in 1987. A major rule change being considered is a change in the definition of highly erodible cropland to make it consistent with that being used for implementing the conservation compliance provision of the Act.

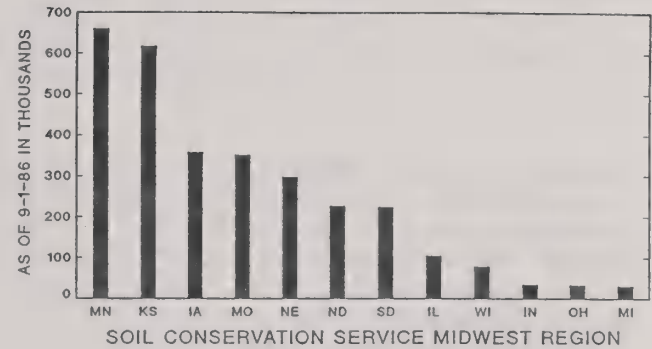
Progress by States

The following charts show the status of the CRP in each state and SCS National Technical Center as of the end of fiscal year 1986.

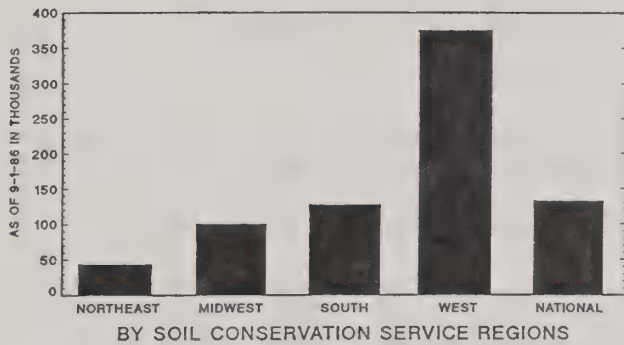
CONSERVATION RESERVE PROGRAM
ACRES ACCEPTED BY REGION
FIRST THRU THIRD SIGNUPS



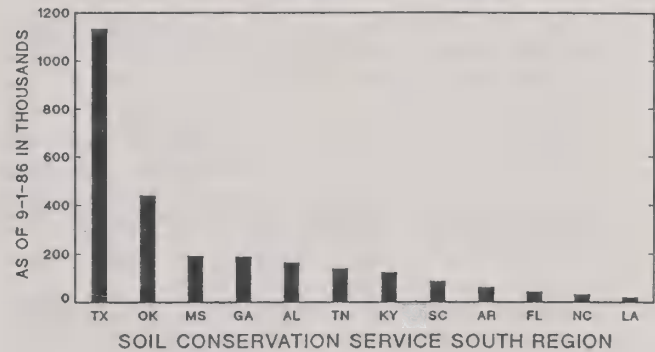
CONSERVATION RESERVE PROGRAM
CRP ACRES ACCEPTED BY STATES



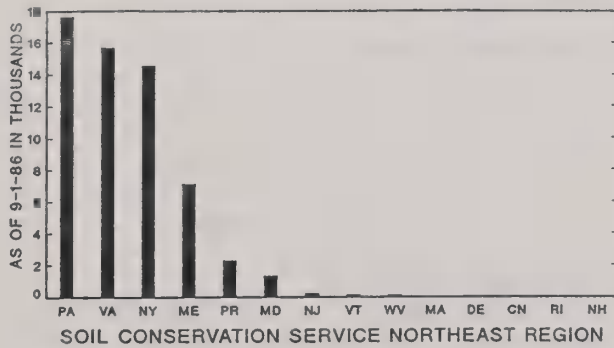
CONSERVATION RESERVE PROGRAM
AVERAGE ACRES PER CONTRACT



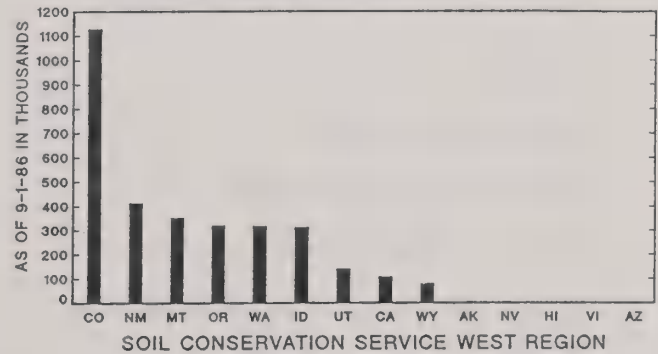
CONSERVATION RESERVE PROGRAM
CRP ACRES ACCEPTED BY STATES



CONSERVATION RESERVE PROGRAM
CRP ACRES ACCEPTED BY STATES



CONSERVATION RESERVE PROGRAM
CRP ACRES ACCEPTED BY STATES



New Plant Materials for Conservation Reserve

Jack R. Carlson, Regional Plant Materials Specialist, USDA
Soil Conservation Service, Portland, OR

Cropland retirement programs have stimulated the development of a grassland seed industry over the past 60 years. Starting with the Dust Bowl of the thirties, followed by Soil Bank, various set-aside programs, and now with Conservation Reserve, millions of pounds of grass and legume seed have been produced, marketed, and planted to provide vegetative cover, control erosion, and ultimately provide forage for livestock and habitat for wildlife.

In programs prior to Conservation Reserve, a few species have dominated the market. For example, crested wheatgrass was extensively used following the Dust Bowl in the Intermountain area and Northern Great Plains, and old seedings have provided a tremendous reservoir of seed for subsequent programs. However, today landowners have a wide variety of grass, legume, and shrub species and cultivars to fit their particular needs. Following are a list of plant materials available for grassland plantings for major Conservation Reserve areas (in order of most recent cultivar):

Cool-Season Grasses

Crested wheatgrass — Hycrest, Ephraim, Ruff, Parkway, P-27, Summit, Nordan, Fairway.

Western wheatgrass — Rodan, Walsh, Flintlock, Arriba, Rosana, Barton.

Russian wildrye — Bozoikey-select, Swift, Cabree, Mayak, Sawki, Vinall.

Intermediate/Pubescent wheatgrass — Clarke, Slate, Tegmar, Greenleaf, Luna, Oahe, Chief, Topar, Ree, Greenar.

Bluebunch wheatgrass — Secar, Whitmar.

Dryland orchardgrass — Paiute, Berber, Palestine.

Green needlegrass — Lodorm, Green stipagrass.

Idaho fescue — Nezpurs, Joseph.

Arizona fescue — Redondo.

Sheep/hard fescue — Covar, Durar.

Bluegrass — Canbar, Sherman.

Wildryes — Shoshone, Magnar, Prairieland, Volga.

Indian ricegrass — Nezparr, Paloma.

Thickspike wheatgrass — Elbee, Critana, Sodar.

Warm-Season Grasses

Little bluestem — Cimmaron, Camper, Aldous, Blaze, Pastura.

Big bluestem — Bonilla, Niagara, Rountree, Pawnee, Champ, Kaw.

Sand bluestem — Goldstrike, Elida, Woodward.

Switchgrass — Sunburst, Trailblazer, Alamo, Cave-in-Rock, Caddo, Summer, Kanlow, Nebraska 28, Pathfinder, Blackwell.

Indiangrass — Rumsey, Lometa, Cheyenne, Llano, Nebraska 54, Osage, Oto, Holt.

Sideoats gramma — Niner, Haskell, Killdeer, Pierre, Premier, Trailway, Butte, Coronado, Uvalde, Tucson, El Reno, Vaughn.

Blue grama — Hachita, Lovington.

Legumes/Forbs

Grazing/dryland alfalfas — Drylander, Roamer, Rambler, Travois, Teton, Ladak, Ranger, Rhizoma, Nomad, others.

Cicer milkvetch — Monarch, Oxley, Lutana.

Sainfoin — Nova, Rumenex, Remont, Melrose, Eski.

Lewis flax — Appar.

Sunflower — Prairie Gold, Aztec.

Forage kochia — Immigrant.

Bundleflower — Sabine.

Rough oxeye — Midas.

Penstemons — Cedar, Bandera.

Prairieclover — Kaneb.

Grayhead prairie-coneflower — Sunglow.

Pitcher sage — Nekan.

The Tye Paratill

A.O. Smith, Representative, The Tye Company, Lockney, Texas

Shrubs

Fourwing saltbush — Rincon, Wytana.

Winterfat — Hatch.

Bitterbrush — Lassen.

Other species and cultivars are being used throughout the country for Conservation Reserve, but this list reflects the greater number of choices available today. Future selection and breeding work will increase the availability of forbs and shrubs.

The Tye Company in Lockney, Texas, manufacturer of well-known planting equipment including the Tye Pasture Pleaser and Tye Grass Drill, is now manufacturing a soil loosener: the Tye Paratill (TM). The Paratill utilizes uniquely designed and patented legs initially used on the Howard Paraplow, which was introduced to the United States in the 1980's. The Paraplow is no longer being produced and marketed in the United States.

The Paratill is furnished with spring swivel coulters in front of each leg that cut through trash and residue. The specialized legs are right- and left-handed to eliminate side draft. This permits the straight toolbar design for back-and-forth operation unlike the moldboard-style Paraplow, which required circular operation. The new toolbar design also allows greater versatility in leg spacing to achieve a total loosening or a zone loosening profile.

The unique patented leg differs from a ripper shank in that the leg and point are not in the same vertical plane. The Paratill leg angles 45 degrees laterally to the point that operates approximately 8 inches to the side and 14 to 16 inches below the ground entry point of the leg. At this operating depth, there are 23 to 25 inches of vertical leg clearance between the ground surface and the bottom of the toolbar. The compacted soil flows over the angled leg (protected by replaceable wear surfaces) and is lifted, bent, and fractured. No mixing of subsoil and top soil occurs; no clods are brought to the surface; and surface residue remains undisturbed to prevent erosion. Paratilled ground will stimulate root development and improve water infiltration/absorption. Deep fertilizer placement can also be achieved with the Paratill.

The Tye Paratill is available in three-point hitch models with shear-bolt or mechanical trip protected legs. A 4-leg unit with shear-bolt protected legs retails for \$6350. For more information, contact The Tye Company, Box 218, Lockney, TX 79241, 800-523-9920 or 806-652-3367.

Low-Volume Irrigation Pumping with Wind Power

R. Nolan Clark, Agricultural Engineer, Southern Plains Area Conservation and Production Research Laboratory, USDA ARS, Bushland, Texas (Presented by Dan W. McKenzie, USDA Forest Service, Technology and Development Center, San Dimas, California)

One of the recent research approaches to improving the overall efficiency of the American water-pumping windmill is the use of a variable stroke mechanism. This may be achieved by matching the pump load to the power available in the wind. A comprehensive laboratory and field study on the American multibladed windmill is in progress at the USDA Conservation and Production Research Laboratory, Bushland, Texas.

Phase one of the project involved laboratory and field testing of performance characteristics of three different piston pumps and the erection of two 8-foot Dempster windmills. Field performance data has been collected from one conventional windmill during the months of September and October 1987. Measurements of pumping rate, discharge pressure, sucker rod tension, stroke length, and stroke speed were made using data loggers. These data are being analyzed, along with windspeed data.

Phase two involves the laboratory testing of two variable stroke mechanisms for engineering feasibility and workability. Such mechanisms should improve the match between the pumping load and the power from the rotor. The average pumping torque for a given lift and flow rate is constant, whereas the available rotor torque increases with the square of the windspeed. One mechanism uses a spring as a part of the pump rod to cause the stroke length to increase with increased rotor speed, thus increasing the water pumped by the windmill.

The second design causes the stroke length to shorten at windspeeds below the rated speed. This reduces the loading torque requirement and allows the windmill to start and run at lower windspeeds. When the windspeed exceeds the rated speed, the mechanism will cause the stroke length to increase, which increases the volume of pumped water. A detailed report will be prepared following the field testing of the two mechanisms.

Evaluation of Effectiveness of Pneumatically Seeding Slopes for Erosion Control

John Haynes, Landscape Architect, Transportation Erosion Specialist Erosion Control & Geotextiles Unit and Thomas P. Hoover, P.E., Sr. Materials & Research Engineer, Erosion Control & Geotextiles Unit, State of California, Business, Transportation and Housing Agency, Sacramento, California

This research project was to evaluate new equipment that allows seed to be applied to slopes pneumatically. There is interest in evaluating the equipment to determine if it would be beneficial in apply erosion control materials. Some of the districts require that legume seed be applied dry. This requirement is the result of concern that inoculant is removed from the seed when applied with a hydromulch system. It is difficult and time consuming to apply seed on steep slopes with conventional manual equipment. This equipment may also provide an alternative for seeding and fertilizing small areas without hydromulch.

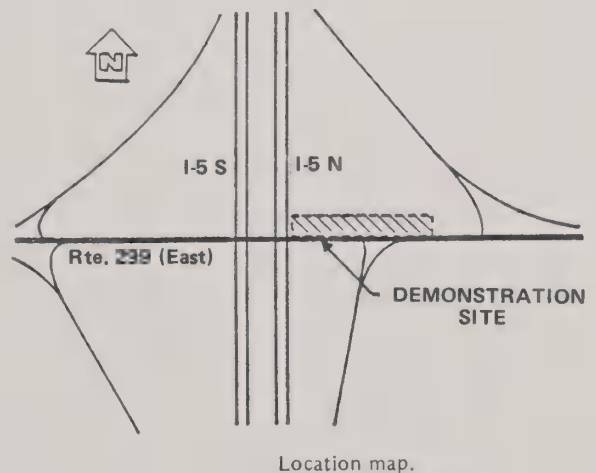
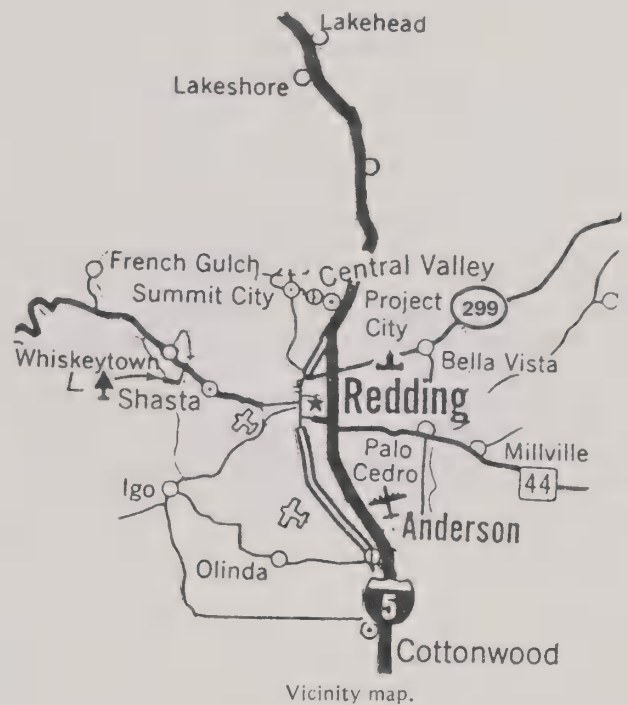
The equipment is called a Ferti-Blast gun and is manufactured by Chowning Regulator Corporation of Corning, New York (See exhibit 1). It is assumed from the name that the gun was originally intended to apply fertilizer. It is being promoted locally by CelPril Industries to apply coated seed as well as fertilizer. CelPril is in the seed coating business and anticipates selling more of their products if Caltrans uses the Ferti-Blast gun to apply seed. CelPril provided the seed used for this demonstration as well as the Ferti-Blast gun.

The site selected for this research is in District 2, in Redding on Route 5 at the junction with Route 299 East. This site was selected for three reasons. There is an existing slope that is severely eroded; the District Landscape Architect requires legume seed to be applied dry; and Redding is located about halfway between Sacramento and Hermiston, Oregon, where the Ferti-Blast gun was available.

The test plot is a fairly steep south-facing cut slope. It was originally constructed at 2:1. The lower portions of the slope have eroded badly and are rutted. The soil is a cobbly gravel that is loosely cemented with fines. The loose gravel on the surface and the steep slope make foot traffic very difficult, almost impossible. There is little existing vegetative cover over much of the slope. What cover there is consists primarily of annual grasses. The areas actively eroding were devoid of grasses. The talus fans at the bottom of the slope had a good stand of grasses and forbs.

There is one group of native shrubs that have re-established on a small area of the lower part of the slope. The majority appears to be about 5 years old with a few younger shrubs. Some of the shrubs have established in the loose material at the bottom of the gullies. Because of the density of the plants, it isn't possible to tell if the remainder are in gullies

or not. There is good cover of oak trees, manzanita, and other shrubs at the top of the cut slope. There is a sufficient seed supply for native plant invasion, but until the slope is stabilized, complete revegetation will not occur.



Conclusion and Recommendations

The Ferti-Blast gun has a very good potential application in Caltrans. It will be of limited use in applying lightweight grass seed because of the short distances the seed is blown. There may be cases where maintenance can apply seed on low slopes that haven't previously been seeded or where the original seeding didn't survive. If this work was done immediately before the rainy season, there is a substantial chance that it would be successful.

The Ferti-Blast gun could also be used in situations where dry-applied legume seed is specified. The District 2 landscape architect now allows the use of equipment to pneumatically apply legume seed. When pneumatically applied, the seed must still be covered with a mulch.

The optimum use of the Ferti-Blast gun is for refertilization of erosion control or landscaped areas. Many times the original erosion control treatments applied are satisfactory for only a few years. They decline as the fertilizer is utilized. Except for the gun itself, maintenance has all the required equipment to apply fertilizer. With the use of the Ferti-Blast, many acres could be fertilized in a very short period of time.

As a part of this research project, the demonstration of the Ferti-Blast equipment was video taped to distribute the information to the districts. However, due to the inexperience of the operator, the quality of the tape is very poor and is not worthy of circulation.

Investigative Method

No specialized equipment, except the Ferti-Blast gun, is needed to pneumatically apply seed. A portable air compressor of 125 cubic feet/minute capacity at 100 pounds pressure is required to blow the seed or fertilizer. The Ferti-Blast gun has a 7-foot length of 1-inch suction hose and a 12-foot length of 1/2-inch air supply hose. Seed or fertilizer can be sucked directly from bags. If mixed seed is to be applied, as it was in this demonstration, a container for the seed is required. We used a 17-gallon galvanized tub. A small truck to carry materials and to work from is also needed.

The seed used was selected by size to determine the distance various weights of seed could be blown. The following seed varieties were used:

Name of Seed	Seeds per Pound (without coating)
Trifolium hirtum 'Hykon' Hykon rose clover	140,000
Bromis mollis Blando brome	270,000
Dactalis glomerata 'Berber' Berber orchardgrass	654,000
Vulpia myuros 'Zorro' Zorro foxtail fescue	994,000

To determine how far the seed would carry, 3-foot squares of glue-coated kraft paper were spaced out on the slope. The bottom edge of the first square was placed 20 feet (slope measurement) from the toe of the slope; the second was placed 30 feet and the third was 40 feet. The paper squares were sprayed with a 3-M brand adhesive so the seed would stick. Six-inch excelsior blanket staples were used to anchor the corners of the collection papers.

The seed and fertilizer were applied by District 2 maintenance. They provided the personnel, a truck, the compressor, and traffic control. A shoulder closure was required. Three people were used for the operation. One drove the truck, one held the suction hose, and the third operated the Ferti-Blast gun. With experience or with a weighted suction hose, the second person might be eliminated.

The seed was dumped into the tub and hand mixed. The objective was to have similar volumes of seed rather than equal weights. The tub of seed was placed on the bed of the truck and the suction hose was rotated to randomly pull up the seed. As the truck slowly moved, the operator moved the gun back and forth and up and down, blowing seed on the slope. It was difficult to tell how evenly the seed was distributed. This researcher assumes that with experience, an operator could get relatively even results. An evaluation will be done this spring to determine the uniformity of application.

After the entire slope was seeded, the truck began again and applied the fertilizer. The fertilizers were sucked directly out of the bag. Two different fertilizers were used. The first half of the slope received 16-20-0 (with sulphur), the second half received 0-25-0 (with sulphur). The two fertilizer formulations were used in an attempt to evaluate the performance of the legume in the seed mix.

The glue-coated paper did not perform as expected. The day was warm and a north wind made the air very dry. This caused the glue to lose some of its tackiness and not all the seed stuck to the paper. None of the pelleted clover or fertilizer stuck. It is possible that the shape and velocity of the seed and fertilizer caused it to bounce off the paper. Nonetheless, from the seed that did stick, it could be determined how effectively the Ferti-Blast distributed the various sizes of seed. There was a good distribution of grass seed on the lowest paper, indicating that seed could be easily blown 20 feet. The next paper up the slope had much less cover, with very little of the small Zorro seed. The two larger seeds were present, but much less so than on the first paper. The third paper, at 40 feet from the bottom of the slope, had virtually no seed. This was out of range of the Ferti-Blast, which is consistent with CelPriel's literature.

Even though the clover seed and fertilizer did not stick to the paper, from personal observation from the upper slope while the seed was being shot, it was easily seen that the Ferti-Blast could propel the denser material out 50 to 60 feet. Distances over 60 feet would have been past the top of the slope being seeded, providing a limitation to the test. The seed may roll or be blown to the bottom of the slope on smooth slopes if there is no cover to hold it in place until it germinates. A rough slope is required to maintain the distribution achieved during installation.

Use of Disk Chain on Southern Idaho's Annual Rangeland

Mike Pellant, USDI Bureau of Land Management, Idaho State Office, Boise, Idaho

In 1984 the Bureau of Land Management (BLM) in Idaho initiated a wildfire presuppression program, greenstripping, in an effort to reduce the size and frequency of destructive wildfires. Greenstripping is the establishment of strips of fire-resistant vegetation at strategic locations to slow or stop the spread of wildfires. Wildfires are increasing due in large part to the dominance of cheatgrass (*Bromus tectorum*) and other alien annual species on 2 million acres of public lands in southern Idaho.

Competition from these annuals must be reduced before seeding greenstrip plant materials. In 1986 the USDA Forest Service Shrub Sciences Laboratory in Provo, Utah, first loaned Idaho BLM a disk chain to complete trial greenstrips south of Boise, Idaho. A modified disk chain was used on another greenstrip project later that year. Further modifications to the disk chain were proposed and the latest disk chain (see figures) was jointly constructed by BLM's Boise District (chain and disks) and the Missoula Technology and Development Center (roller bar, frame and seedbox attachment). Total cost to construct this disk chain was \$25,000.

This new disk chain offers several improvements over earlier versions. Truax seedboxes have been mounted on a frame over the roller bar, which promotes better seed dispersion and more accurate calibration. The heavy frame and seedboxes have also increased seedbed compaction to improve soil to seed contact. Three different seedboxes (grass, legume and "trashy") have been installed to provide flexibility to plant diverse seed mixtures. Shrub restoration as well as greenstripping projects will be completed with this machine.

The chain/disk arrangement has also been modified by bolting disks to the chain instead of welding them on. This has greatly reduced the amount of disk breakage and will facilitate replacement of broken disks. A 24-inch disk has been placed on every other chain link on this version. At an operating speed of 3 mph, annual species seed/plants are buried 3 to 4 inches.

In the fall of 1987, this modified disk chain was used to seed 517 acres of greenstrips near Mountain Home, Idaho. Excluding equipment set up and breakdown time, about 35 acres could be seeded per 10 hour work day at an average cost of \$8.50 per acre. Equipment set up and breakdown takes a two-person crew with a forklift about 6 hours to complete.



Greenstripping project near Boise, Idaho.



D-7 caterpillar tractor pulling a disk chain. A 30-foot wide swath is seeded by this disk chain.

Goats, Their Control and Use as a Biological Agent Against Leafy Spurge

Vincent T. McElligott, Student, Montana State University; Charles N. Sundt, USDA-FS Gallatin National Forest; Pete K. Fay, Professor Weed Plant and Soil Science, Montana State University; and Kris Harstead, Professor Range Management, Montana State University, Bozeman, Montana

Abstract

Leafy Spurge (*Euphorbia esula*) currently infests more than 1 million hectares in North America. While goats utilize leafy spurge, they are difficult and expensive to contain. The effectiveness of electric shock collars for containment of goats was tested. The degree of use and preference of leafy spurge by goats was tested in plots consisting of brush, grass, and various forb species. Goats did effectively utilize leafy spurge, but their use as a control agent is questionable. The use of radio collars was proven to be effective in containing the goats.

Introduction

A fast growing perennial, leafy spurge spreads rapidly by a horizontal root system and efficient seed dispersal. It competes aggressively with natural vegetation, effectively reducing forage for wildlife and domesticated livestock. According to the U.S. Department of Agriculture, leafy spurge is a species least likely to be controlled by biological means. In 1983, in Stillwater County, Montana, goats were found grazing on leafy spurge on an island in the Yellowstone River. Their preference for this plant was noted and further study was conducted by the Stillwater Weed Management District, in cooperation with the Montana Department of Fish, Wildlife, and Parks, and the Stillwater County Extension Service.

In 1986, with the development of the Environmental Impact Statement for the Gallatin National Forest, alternatives to chemicals for controlling noxious weeds were being researched. When considering biological control for leafy spurge, data from the Stillwater experiments were noted. Control of goats as a biological agent was questioned and Montana State University was contacted. In 1987 a project proposal and memorandum of understanding was developed between the University and the USDA Forest Service to study the effects of and control of goats on leafy spurge.

Methods and Materials

The Invisible Fence[®] is an electronic containment system currently being used to contain dogs. The Invisible Fence[®] was implemented into this study to test containment of goats on leafy spurge infested pastures without conventional

fencing. The system consists of a radio receiver collar worn by the goats, a radio transmitter, a 12-volt battery, and a single strand of 14 gauge wire. The insulated wire is placed on the ground in the desired perimeter around the spurge infestation. The wire loops from the transmitter around the infestation then back to the transmitter to complete the circuit. The radio transmitter sends a weak radio signal through the wire that produces a radio field 3 to 6 meters wide parallel to the wire. When a collared goat approaches the wire, a radio signal is received by the shock collar, which emits a warning tone followed by a shock two seconds later if the animal fails to retreat.

Twenty-two goats were used in the experiment. In experiment one, eleven goats were selected from the herd. Six goats were chosen from this group to wear collars. Their training was done by placing them in a 30 X 30 meter pasture enclosed with a snowfence. The 14 gauge insulated wire was placed on the snowfence with a radio signal being transmitted for a distance of 3 meters. In experiment two, five of the remaining eleven goats were picked at random and trained to the collar.

Two experiments were designed to test the control of goats and to measure utilization of leafy spurge. In experiment one, to test containment, the trained goats were collared and run with five untrained uncollared goats. Location of the goats in respect to the containment area was checked six times each day for a period of 12 days. All goats were penned at the end of each day. The experiment site consisted of spurge, brush and grasses and a 70 X 70 meter square enclosure. Utilization of leafy spurge was taken by daily stand counts. An "M" shaped pattern was designed across the experiment site to be used as a guide in stand counts. A 1-meter square grid was dropped five times on each leg of the "M" and the total number of spurge plants found within the grid counted. The percentage of flowering to non-flowering plants was read to give an accurate measurement of utilization. Twenty-five 1-meter square stand counts were taken daily. One-meter square vegetation clips were taken every 4 days at ten locations. The vegetation was separated into spurge, forbs and brush, and grasses, dried and dry biomass weight recorded.

In experiment two, the remaining eleven goats were used. Five of these goats were picked at random to wear collars and trained for 4 days. These goats along with six untrained goats were placed in the test site. One collar was removed from the collared goats randomly every 3 days. Location of the goats in respect to the containment area was checked ten times each day for a period of 18 days. All goats were penned up at the end of each day. Test site and size were designed as in experiment one with the exception that twenty 1-meter square stand counts were taken per day to measure spurge utilization. Above ground biomass was measured as in experiment one.

Results and Discussion

The six dominant goats chosen to wear the collars in experiment one and the five goats in experiment two were placed within the training enclosure. Within 10 minutes each goat had received four to five shocks before finding the "safe" zone. The goats did not memorize their perimeter, but quickly associated the sequence of the warning tones to the shock that followed after entering the radio field. These goats became cautious and soon responded only to the tone, retreating before the shock. The animals were left in the training enclosure for 5 days before field experiments were conducted.

Experiment one was conducted in a 70 X 70 meter area enclosed by the insulated wire. The area was in a large pasture and heavily infested with spurge. Common plants species found in the experiment site consisted of leafy spurge, woods rose (*Rosa woodsii*), buffberry (*Shepherdia argenta*), kentucky bluegrass (*Poa pratensis*), needle and thread (*Stipa comata*), western wheatgrass (*Agropyron smithi*), blue grama (*Bouteloua gracilis*), dense clubmoss (*Selaginella densa*), and fringed sage (*Artemisa frigida*).

Six trained goats were collared and five untrained uncollared goats were placed in the study area. The uncollared goats were introduced to measure the closeness of herding. The uncollared goats increased the stress on the collared goats as they wandered outside the "invisible" boundry delineated by the 14 gauge wire laid on the ground. Each goat was numbered and its location recorded every 2 hours during the 12-hour grazing day. There were a possible six escapes per day by each goat. There were no escapes by the collared goats during the 12-day study. The containment data that were collected on this experiment suggested that a smaller ratio of collared goats could be used with the same expected results.

Leafy spurge utilization was measured by taking 25 stand counts daily. The "M" shaped pattern was designed across the experiment site as a guide in taking stand counts. A 1-meter square grid was dropped five times on each leg of the "M" daily. The total number of spurge plants that were inside the meter square grid were counted to determine utilization. This utilization was determined by comparing plants with flowers to plants without flowers. The goats' grazing habits were to strip the stalks and eat the seed heads. At 4-day intervals, biomass was taken by clipping 1-meter square plots at ten locations within the transect. These were dried and a dry biomass weight was recorded.

At the start of the experiment 57 percent of the stems within the plots were flowering. At the end of the trial period, based on twentyfive stand counts per day, percent of stems with intact flowers was reduced to 10 percent.

Within the total biomass, spurge made up 52 percent, grasses 24 percent, and forbs 22 percent. Sixty-six percent of the spurge, 24 percent of the grasses and 60 percent of the forbs

were utilized. Overall diet by weight consisted of 62 percent spurge, 13 percent grasses, and 25 percent forbs.

Experiment two was conducted in a 70 X 70 meter area enclosed by the insulated wire. Site location was in a large open area infested with spurge. Common plants found in conjunction with spurge were needle and thread, western wheatgrass, woods rose, and choke cherry (*Prunus virginiana*).

Five randomly selected goats were collared and placed with six uncollared goats within the enclosure. At 3-day intervals, one goat with a collar was randomly selected and the collar removed. Each goat was numbered and the location was recorded ten times per day for a period of 18 days. A total of eight escapes were recorded during this trial. All escapes were by the same goat, which was an extremely nondominant animal.

At the start of the experiment 57 percent of the stems were flowering. At the end of the trial period, based on 20 stand counts per day the percentage of the stems that had flowers was reduced to 7 percent by grazing.

Within the total biomass, spurge made up 71 percent, grasses 11 percent, and forbs 18 percent. Forty-nine percent of the spurge, 14 percent of the grasses, and 70 percent of the forbs were utilized. Overall diet by weight consisted of 72 percent spurge, 3 percent grasses, and 25 percent forbs.

Conclusions

Goats utilize leafy spurge. In both tests, the majority of their diet was spurge even though other forage species were available. While utilization of spurge was impressive, brush and forb species were significantly impacted. This study indicates that other means of control may be more favorable in some environments, due to the heavy impact of goats on desirable species.

The electronic fence proved to be an effective method of containing goats. Experiment one had no escapes during the trial period. In experiment two, eight escapes did occur, however, they were all from the same goat. The use of the electronic fence may have possibilities in providing a means to control herbivores in various grazing systems, exclusions of lands, or special treatment areas such as control of noxious weed in areas restricted to herbicide application.

Additional information is needed to determine the effects of continuous heavy grazing on spurge. No analysis of fecal content was conducted to determine if viable seed was present. This information would be useful in analyzing possible spread of weed infestations if goats were used as a biological control agent.

Timing as to the season of use was not considered. Effect on plant vigor and health may be greater if grazed early in the growing season.

New Resource Tools and Equipment

Richard G. Hallman
Resource Planner

A variety of new tools designed to make reforestation tasks more efficient and economical have recently been developed or improved by Missoula Technology and Development Center (MTDC) engineers. The improvements are part of the continuing cooperative effort to help resource managers solve problems inherent in wildland reforestation.

The Salmon Blade

The Salmon Blade is an improved tractor-mounted blade designed for wildland site preparation. Many commonly used scarification techniques do not effectively eliminate competition from undesirable vegetation. Dozer blade scarification often disturbs too much of the ground cover so that soil moisture is lost and erosion is encouraged. Dozer-mounted brush blades create furrows that often fail to kill the grass because roots are not adequately exposed. The Salmon Blade is adapted from a dozer-mounted brush blade and is designed to turn over grass to expose the roots. Treatment with the Salmon Blade effectively kills unwanted vegetation. The Salmon Blade produces a series of furrows that catch and hold seed and water and provide an ideal microsite

for regeneration. The blade rescatters slash or piles it.

The Salmon Blade was developed cooperatively by Douglas Basford, forester on the Salmon Ranger District, Salmon National Forest in Idaho; Robert Herman, heavy equipment mechanic on the Salmon National Forest; and Ben Lowman, project leader at MTDC. The blade was modified from a commercial brush blade and extensively tested during the 1986 and 1987 field season in pine grass and on a variety of slash and ground conditions. Approximately 400 acres on the Salmon National Forest were treated with the blade.



The Salmon Blade.

The Salmon Blade features plow-like attachments on each tooth, which turn the soil to create varying amounts of soil disturbance. After treatment, an adequate seedbed should exist for 5 to 10 years, so site preparation for natural regeneration can continue in both seed and nonseed years. Stocking levels of 1,000 to 6,000 seedlings per acre are reported on the Salmon National Forest. Production rates ranged from 1½ to 2 acres per hour in grass cover with little or no slash and 1 to 1½ acres in moderate slash. Cost per acre in areas needing only scarification ranged from \$75 to \$85 per acre. The recommended machine size for this blade is 95 to 130 horsepower.

Advantages:

- Blade design increase production with less disturbance to remaining trees.
- Blade can pile brush or scarify.
- Blade depth is easy to control because it is mounted on the front of the tractor.
- Different levels of scarification can be achieved by fluctuating the blade depth to produce various sized furrows.
- One trip with a tractor over an area can produce adequate soil disturbance for seedbeds.
- Adequate seedbeds should exist 5 to 10 years after treatment.
- Scarifying and rescattering the slash on the site produces microsites for young seedlings. This reduces slash piling and burning up to 90 percent on Douglas-fir sites.
- Scarifying up to the base of existing trees in a shelterwood cut allows seedlings to establish themselves near these trees. This should produce better uniformity and improved seedling survival.

As with most dozer attachments, the Salmon Blade is not recommended for slopes exceeding 35 percent.

Drawings for building the blade are available from MTDC. Fabrication cost for the attachments to the teeth of the brush blade range from \$1,200 to \$2,500. The brush blade with 30-inch teeth costs \$6,000 to \$7,000. The Salmon Blade is also available from two commercial sources:

- Weldco-Beales
2328 Roosevelt Ave.
P.O. Box 8
Enemclaw, WA
(206) 825-3581
- Balderson Inc.
600 Balderson Blvd.
P.O. Box 6
Wamego, KS 66547-0006
(913) 456-2224

Costs range from \$7,200 to \$9,500

The Anchor Chain Scarifier

A rugged, inexpensive scarifier that features anchor chain has been adapted for site preparation in post-logging operations by MTDC engineers. The heavy anchor chain effectively treats light to moderate slash and prepares the ground for natural regeneration. The Anchor Chain Scarifier is adapted from the British Columbia drag scarifier developed in the late 1970's by the British Columbia Ministry of Forests. Engineers at MTDC modified the scarifier by adding heavier chain that rides close to the ground to achieve better disturbance of the soil and better break-up of slash material. Current scarifiers are designed for agricultural treatments and their teeth are not durable enough for forest environments.

The Anchor Chain Scarifier features a V-bar spreader and a single-point hitch with attachment points for drag chains. The spreader is made of 12- to 16-inch well casing with optional 3/8-inch wear plates. MTDC engineers varied the size of the chain links to adjust the degree of scarification. The larger chains treat areas with heavier slash. Chain links ranged from:

<i>Chain Size</i>	<i>Chain Weight Per Link</i>
2-inch stud-link chain	25 lb
2½-inch stud-link chain	50 lb
3-inch stud-link chain	86 lb

Steel cross-bars add an average of 18½ pounds per link. Time elapsed since logging, the amount of slash remaining, vegetative competition, soil moisture, duff depth, stump density and height, and degree of slope determine scarification treatment.

The Anchor Chain Scarifier was tested on partial cuts on the Northern Region Lolo National Forest. The tests used a crawler-tractor in the 100 hp class. Slopes ranged from 35 to 45 percent. The scarifier averaged 1 acre per hour. It operated best in an up-and-down hill pattern followed by a criss-cross

side-hill configuration. The goal of 35 percent scarification treatment was easily met.

The Anchor Chain Scarifier costs \$6,000 to \$8,000 depending on materials and cost of labor. Maintenance costs are low. Most repairs can be made with a welding torch.

A video of the Lolo National Forest tests, design drawings, and a materials list are available from MTDC.



Anchor chain scarifier.

Portable Power Platform

The Iron Horse Wood Caddy tractor is an off-road vehicle that transports equipment and supplies and provides a lightweight power source for operating implements and hand-held tools. The machine is easily operated by one person and costs about \$5,500.

MTDC chose this machine as the most promising portable power source for performing forestry tasks. Forestry workers placed a high priority on a portable power source in a Servicewide survey conducted in 1986. They asked for an off-road vehicle that could safely climb a 60-percent slope and operate on a 35-percent grade. They wanted a machine that would operate at variable speeds at or near maximum grade engine rpm and one that could operate accessories by direct drive or electrical generation. They also wanted the vehicle to be operated by a non-riding driver. The Iron Horse appears to meet these needs. MTDC engineers will conduct field tests in 1988 to evaluate the machine for forestry field work.

The Iron Horse is simple to operate. The steering arm runs from a clutch that transfers all the power to one track to initiate turns. Its application for forestry work seems unlimited. The roller, winch, and trailer can accomplish most tasks associated with precommercial thinning, slash disposal, and

release cutting. Delimbing and yarding operations are simple even in tight spots, which makes the machine especially useful for wood gathering, residue treatment, and post-and-pole operations. Because of the low ground pressure, the Iron Horse is well suited for operating on soft ground or in environmentally sensitive areas. Using the flat bed box and seedling frame, the Iron Horse can transport seedlings, tools, or heavy bulky materials in and out of the woods.

MTDC engineers have begun modifications to make the Iron Horse even more versatile. A steel mounting platform has been fitted to the load bunks, to accommodate a "Lil Chipper" brush chipper (manufactured by Limco, Inc.) and a spray applicator for applying herbicides (manufactured by Fenco). The modification costs approximately \$400. A parts list and line drawings are available from MTDC. Modifications for direct drive units or electrical generation allow mechanical site preparation, planting, direct seeding, cone collection, slash disposal, or plantation maintenance. These modifications may also accommodate power scalpels, scarifiers, tillers, flail trenchers, nordic trail track setters, snow plows and snow blowers, planting augers, interseeders, hydroseeders, seed blowers, water pumps, and mulchers. A variety of hand tools may be powered by the machine as well. The modifications will be part of the 1988 field tests.



Portable power platform.

Hammer-Action Hand Planter

A hammer-action hand planter has been designed to plant seedlings in rocky soil. Although commercial hand planters perform well in ideal soil conditions, the operator continuously absorbs the shock while operating the auger in rocky soil. Hammer-action uses an inner staff with a tool head attached. The hammer head and handle/slider tube incase the staff. The operator simply raises the handle/slider tube the length of the staff and slams the hammer head down against the staff stop. The force generated drives the tool head into the ground to create a suitable planting hole.

MTDC began work on the hammer-action planter in FY 1987 in respose to a request for help from the Intermountain Station at Boise, Idaho. They were planting willows rooted in super tubes on a rocky site near Vale, Oregon. Shallow, narrow planting holes were required. The conditions at the site ranged from sand-sized particles to rocks 12 inches in diameter. The site had spaces filled with silt between rocks with vegetation ranging from heavy sod to Kentucky blue grass and clover.

MTDC engineers converted three commonly used commercial planting tools to the hammer-action design. A T-handle and a double-D handle were fitted to the head:

KBC Bar—Creates standard 12-inch or deeper holes for bare root stock. Blade is 4 inches wide x 12 inches long x 1-inch thick and tapers to a point.

DD-Handle: Length 48-5/8 inches
Weight 20 pounds, 10 ounces

T-Handle: Length 44-5/8 inches
Weight 17 pounds, 15 ounces

OST Bar—Creates 12-inch or deeper holes for bare root stock. Blade is 3 inches wide x 10-3/4 inches long. Blade thickness tapers to a thin wedge.

DD-Handle: Length 48-5/8 inches
Weight 20 pounds, 10 ounces

T-Handle: Length 44-5/8 inches
Weight 17 pounds, 15 ounces

Super Leech Pine Dibble—Designed for planting containerized stock in super tubes. Dibble length: 9 inches x 1-3/4 inch diameter. Tapers to 1 1/4 inches at the tip.

DD-Handle: Length 46-3/4 inches
Weight 21 pounds, 8 ounces

T-Handle: Length 42-3/4 inches
Weight 18 pounds, 10 ounces

The hammer-action tools were used to plant the Vale site in 1987. Results showed:

1. The hammer-action planters were more effective than conventional spades and planting bars.

2. The super-dibble tip and the OST bar tip were most effective at the Vale site. The OST bar was used to pry rocks.

3. The tools were generally considered too heavy and the handle length was thought to be too short.

MTDC engineers incorporated the recommendations into the hand planter. Each of the three hammer heads has been fitted to DD and T handle designs for the 1988 field season.

The hammer-action planter costs about \$50. Drawings are available from MTDC.



Hammer-action hand planter.

Planting Auger

A cone-shaped, power-driven auger has proved effective in planting seedlings in rocky soils. Seedlings planted with the tapered auger have achieved a 90-percent survival rate after 5 years. The cone-shaped auger was the concept of Russ Ryker, an Intermountain Forest and Range Experiment Station research scientist. His auger was used to plant a rocky planting site on the Mountain Home Ranger District on the Boise National Forest in 1983. The auger was 14 inches long with an 8-inch diameter top that narrowed to a 4-inch bottom. Results were compared to those achieved with straight-sided augers. After five growing seasons, seedlings planted in the tapered holes had a greater survival rate. Mean seedling heights were similar in all treatments.

In 1986 MTDC was asked to refine the cone-shaped auger. MTDC built six prototypes with auger length varying from 30 to 34 inches and bit length from 14 to 21 inches:

2½-inch to 6-inch taper with double flighting

4 spiraled angle fins

1¼-inch to 6-inch taper with double flighting

1-inch to 4-inch taper with 1-inch wide flighting

1¼-inch to 6-inch taper with single flighting

4-inch to 6-inch taper with two-step/single flighting with 6 inches between steps

The six prototypes were evaluated on the Boise National Forest in 1987. Further refining resulted in a 30-inch long, cone-shaped auger with an 18-inch bit length. The MTDC auger featured a 3- to 6-inch taper with double flighting and three steps.

The improved MTDC cone-shaped auger was compared to a commercial straight-bit auger during the 1987 field season. Both augers planted seedlings on a site characterized by heavy rock, light sub-surface organic debris, and an average amount of soil moisture. The augers were evaluated for ease of operating, amount of glazing, difficulty in penetrating the soil, and the amount of soil left in the hole after augering.

The auger performed well but was heavier than commercial straight-bit augers. User comments led to a final auger that is 30 inches long, has a bit length of 12 inches and weighs 7½ pounds (comparable to commercial augers). The cone-shaped auger costs about \$200. Design drawings are available. Commercial production of the cone-shaped auger is anticipated.

For information on all these improved resource tools, contact Dick Hallman, Resource Planner at the Missoula Technology and Development Center, Bldg. 1 Fort Missoula, Missoula, Montana 59801 (FTS 585-3946 or (406) 329-3946).



Planting auger.

Auger Evaluation

<i>Auger Hole Inches</i>	<i>Tree Placement</i>	<i>Augering Time Seconds¹</i>	<i>Planting Time Seconds¹</i>	<i>5th Year Height</i>	<i>5th Year Survival¹</i>
4	Center hole	45.6 a	195.1 b	57.3	86 ab
4	Side hole	45.2 a	154.9 a	57.7	82 a
6	Center hole	87.7 a	255.3 d	59.3	80 a
6	Side hole	96.0 bc	191.5 b	57.0	82 a
4 to 8	Center hole	81.8 b	232.2 c	62.2	90 b

¹Mean auger and planting time per 10 tree row and fifth year seedling mean heights and survival. Values followed by the same letter are not significantly different at the 95 percent level of confidence.

	<i>Cone Shape (20 operators) percent</i>	<i>Straight bit (15 operators) percent</i>
Ease of Operation		
Hard to operate	20	54
Moderately easy to operate	75	46
Easy to operate	5	0
Amount of Glazing		
Severe	0	0
Moderate	25	20
None	75	80
Difficulty in Penetrating Soil Organic Material		
Severe	0	0
Moderate	50	67
Slight	50	23
Soil in Hole after Augering		
Excessive	0	7
Adequate	90	86
Inadequate	10	7

Equipment Development and Test Funding

Planning and Budgeting Procedure

For many years the "Range Reseeding Committee" was an informal group, meeting each year to exchange information on work of mutual interest and to develop project proposals for work to be done by Equipment Development Centers or field units. The proposals were written, estimated for cost, and finalized "on the spot." Informal, but it seemed to work!

Today there are demands being placed on us to plan in detail 2 years in advance, and in general 5 to 10 years ahead. This does take away some of the informality of the operation and dictates the need for a more organized approach to the preparation and submittal of project proposals. Figure 1 shows a plan by which we can meet our budgeting dates. It provides a mechanism whereby the Technology Development

Centers can stay with the budget process of the Forest Service.

The other aspect of our planning procedure is a more uniform format for project proposals. Figure 2 is a suggested guideline for proposals. Following this guide will help all concerned in preparing and reviewing proposals. It should make the flow of information more efficient and provide a much better story for those who must analyze needs, prepare programs, and assign priorities.

We hope that everyone associated with the Vegetative Rehabilitation and Equipment Workshop will cooperate in this more formal approach. It should be an aid to everyone. If any questions arise or there is a need for help in this process, call the Centers or the Washington Office.

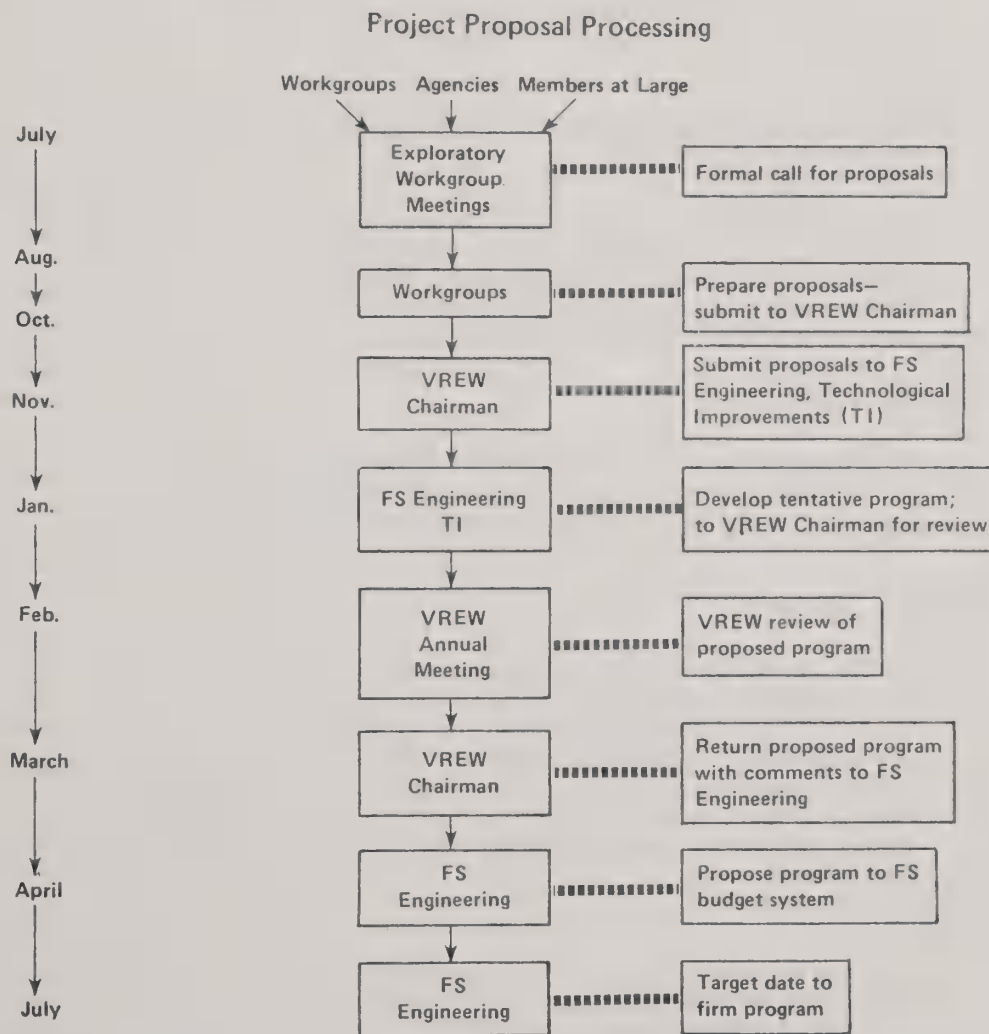


Figure 1.—Project proposal processing.

(Project Proposal Format)

Equipment Development and Test Project Proposal FY _____

ED&T Project No. (Leave Blank)

Date _____

Primary Interest: _____

(Title)

- (The title should be brief and indicative of project objectives.)

Problem Statement and Overall Objectives

- *(State the problem and describe how the work is currently being done. Tell what equipment, materials, or methods are used, and why change or improvement is needed. Show significant advantages and potential savings, such as: increased production or efficiency, property or human hazard reduction, reduced maintenance, and public demand or reaction.)*
- *(State the overall objectives. What is to be accomplished or what is to be achieved by this project?)*
- *(Include amendments to the problem statement and overall objectives, if necessary for completion by the Development Centers for applicable continuing projects only. The statements of the original problem and objectives should not be changed. If there is a change in emphasis, add revised problem statements and objectives here.)*

Specific Requirements

- *(Distinguish between minimum requirements and those which are desired but not essential. Describe features required or specify performance characteristics. Where more information will be needed but cannot be furnished, list items that should be explored.)*

Prior Development

- *(Briefly describe work already completed or underway which is related to this project. On new projects, this work will generally have been done by other persons or organizations or under other equipment development projects. For a continuing project, tell when it started and briefly state major accomplishments, and actions planned for completion in the current fiscal year. Reference the overall project time frame and total cost estimate if previously made and if applicable, prior reports and publications.)*

Project Origin

- *(Show the name, organization, etc. of persons originating the project and preparing the project proposal.)*

Figure 2.—Format for project proposal.

FY 1988 Program
Missoula Technology Development Center

Number	Project	Amount
7E72D22	VREW Information Workgroup Support	\$20,000

Range Publications and Drawings

Below are titles of reports on a variety of range rehabilitation topics, as well as a list of range equipment fabrication drawings. These materials have been produced by the Forest Service Technology and Development Centers at Missoula (MTDC) and San Dimas (SDTDC) and may be of interest to workshop members. Single copies of the reports are available without charge by writing to the appropriate Center. Some drawings are available without cost also; there may be a small charge for others.

Forest Service, USDA
Technology and Development Center
Bldg. 1, Fort Missoula
Missoula, MT 59801

Forest Service, USDA
Technology and Development Center
444 East Bonita Ave.
San Dimas, CA 91773

The list of publications includes *Equip Tips*, concise reports dealing with new equipment, new uses for equipment, and similar topics; *Equipment Development & Test (ED&T) Reports*, documenting major development studies; *Project Reports*, describing the technical details of development work, including procedures, results, conclusions, and recommendations; a number of special reports, ASAE papers, and service manuals are listed under "Other Reports."

Equip Tips

A Portable Power Platform for Forestry Tasks, June 1988—MTDC

Hammer-Action Hand Planter, May 1988—MTDC

Anchor Chain Scarifier, May 1988—MTDC

Improved Planting Auger, May 1988—MTDC

The Salmon Blade, May 1988—MTDC

Tractor-Mounted Scalpers for Site Preparation, April 1986—MTDC

Cable Scarifier for Site Preparation, April 1986—MTDC

Better Handtools for Site Preparation, Sept. 1985—MTDC

Hydraulic Post Puller, Aug. 1984—MTDC

Bitterroot Miniyarder for Light Forest Materials, May 1983—MTDC

Small Yarder for Steep Terrain, May 1981—MTDC

Resource Publication, Dec. 1980—MTDC

Proper Use of Fusees, Feb. 1980—MTDC

Improved Aerial Ignition System, Jan. 1980—MTDC

Protecting Western Conifer Seedlings, May 1979—MTDC

Steep-Slope Seeder for Roadside Slope Revegetation, Feb. 1979—SDTDC

Improved Method for Joining Plastic Pipe, Dec. 1978—MTDC

Seed Dribblers (revision no. 1), July 1977—SDTDC

Spray Boom Assembly, July 1972—SDTDC

Plastic Pipe Laying Machinery, Jan. 1966—SDTDC

Browse Seeder with 20-inch Scalpers, Jan. 1965—SDTDC

ED&T Reports

Catalytic Converter Exhaust System Temperature Tests, Feb. 1977—SDTDC

Slash . . . Equipment and Methods for Treatment and Utilization, April 1975—SDTDC

Clearing, Grubbing, and Disposing of Road Construction Slash, Oct. 1976—SDTDC

Roadside Slope Revegetation, June 1974—SDTDC

Flexible Downdrains, Jan. 1974—SDTDC

Tractor Attachments for Brush, Slash, and Root Removal, Jan. 1971—SDTDC

Results of Field Trials of the Tree Eater, Jan. 1970—SDTDC

Forestland Tree Planter, Sept. 1967—SDTDC

Pine Seed Drill, Sept. 1967—SDTDC

Project Reports

Revegetating Slopes with Geotextiles and Geogrid Systems, Sept. 1985—MTDC

Premo Mark III Aerial Ignition System, May 1985—MTDC

Range Water Pumping Systems—State-of-the-Art-Review, Feb. 1985—SDTDC

Field Equipment for Precommercial Thinning and Slash Treatment, Jan. 1984—SDTDC

Analysis of Spray Deposit Cards Sensitive to Nondyed Sprays, Feb. 1984—MTDC

Preventing Livestock Water from Freezing, Nov. 1983—SDTDC

Rangeland Fencing Systems State-of-the-Art Review, Oct. 1983—SDTDC

Evaluation of the Pettibone Slashmaster Model 900 for Site Preparation in the Lake States, Feb. 1983—SDTDC

Dryland Plug Planter, Dec. 1982—MTDC

Tree-Planting Machine—How Much Can You Afford to Pay for One? June 1981—SDTDC

Sod Mover Bucket, Dec. 1980—MTDC

Tree/Shrub Planter for Roadside Revegetation, Oct. 1980—SDTDC

Observations on Operations of the Pettibone Hydro-Slasher PM 800, Feb. 1980—SDTDC

Basin Blade for Disturbed Land Revegetation, Nov. 1979—MTDC

Plastic Tubes for Protecting Seedlings from Browsing Wildlife, July 1979—MTDC

Mulching-Tilling Equipment for Soil Conditioning, Jan. 1979—MTDC

Evaluating Methods for Joining Polyethylene Pipe, Dec. 1978—MTDC

A Transplant System for Revegetating Surface Mined Lands, Nov. 1978—MTDC

Grapples for Forest Residues Concentration and Removal, Oct. 1978—SDTDC

Field Equipment for Precommercial Thinning and Slash Treatment, July 1978—SDTDC

Modified Hodder Gouger, Dec. 1977—MTDC

An Investigation of Equipment for Rejuvenating Browse, Aug. 1977—MTDC

Survey of High-Production Grass Seed Collectors, Jan. 1977—SDTDC

Remote Sensing for Big Game Counts, Dec. 1976—MTDC

Evaluation of the Vermeer Model TS-44A Tree Spade for Transplanting Trees on Surface Mined Land, Feb. 1976—MTDC

Wildlife Habitat Management Needs, Oct. 1975—MTDC

Using Heat for Sagebrush Control, Feb. 1972—MTDC

Other Reports

41st Annual Report—Vegetative Rehabilitation and Equipment Workshop, Sept. 1987—MTDC

Fences, May 1988—MTDC

Evaluation of the Navcore 1 Positioning System, July 1988—MTDC

New Resource Tools and Equipment, July 1988—MTDC

Facilities for Handling, Sheltering, and Trailing Livestock, June 1987—MTDC

40th Annual Report—Vegetative Rehabilitation and Equipment Workshop, Aug. 1986—MTDC

39th Annual Report—Vegetative Rehabilitation and Equipment Workshop, Dec. 1985—MTDC

Low-Cost Diagonal Fence Strainer (ASAE paper No. 84-1624), Dec. 1984—SDTDC

Improved and New Water Pumping Windmills (ASAE paper No. 84-1625), Dec. 1984—SDTDC

38th Annual Report—Vegetative Rehabilitation and Equipment Workshop, Nov. 1984—MTDC

Reclaiming Disturbed Lands, Nov. 1984—MTDC

Manual of Revegetation Techniques, May 1984—MTDC

37th Annual Report—Vegetative Rehabilitation and Equipment Workshop, Oct. 1983—MTDC

Development of a Containerized Shrub Injection Planter Attachment for a Backhoe—A Prospectus, Jan. 1983—SDTDC

Dryland Plug Planter—Operator's Manual, Jan. 1983—MTDC

History of the Vegetative Rehabilitation and Equipment Workshop (VREW) 1946-1981, Dec. 1982—MTDC

- 36th Annual Report—Vegetative Rehabilitation and Equipment Workshop, Sept. 1982—MTDC
- Punch Seeder for Arid and Semiarid Rangelands—A Prospectus, Sept. 1982—SDTDC
- Development of a Disk-Chain Implement for Seedbed Preparation on Rangeland—A Prospectus, July 1982—SDTDC
- Arid Land Seeder Development—A Prospectus, July 1982—SDTDC
- Equipment for Containerized Tree Seedlings, July 1982—MTDC
- Catalog for Hand Planting Tools, May 1982—MTDC
- Sources of Seed and Planting Stock, Oct. 1981—MTDC
- Sod Mover Operator's Manual, Feb. 1981—MTDC
- Development of a Rangeland Interseeder for Rocky and Brushy Terrain (ASAE paper 80-1552), Dec. 1980—SDTDC
- Equipment for Reforestation and Timber Stand Improvement, Oct. 1980—Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402; Request Stock No. 001-001-00563-1; \$6.50
- 34th Annual Report—Vegetative Rehabilitation and Equipment Workshop, Sept. 1980—MTDC
- Modified Basin Blade—Operator's Manual, Mar. 1980—MTDC
- Sodder brochure, Mar. 1980—MTDC
- Basin Blade brochure, Mar. 1980—MTDC
- Mulching-Tilling System brochure, Mar. 1980—MTDC
- Transplanting System brochure, Mar. 1980—MTDC
- Sprigger brochure, Feb. 1980—MTDC
- Dryland Plug Planter brochure, Feb. 1980—MTDC
- Revegetation Equipment Catalog, Feb. 1980—MTDC
- Agricultural Engineer's Role in Rangeland Improvement and Rehabilitation Equipment (ASAE paper 79-161), Dec. 1979—SDTDC
- Observations on Operations of a Residue Shredder and a Brush Harvester, Sept. 1979—SDTDC
- 33rd Annual Report—Vegetative Rehabilitation and Equipment Workshop, July 1979—MTDC
- Front-End Loader Tree Spade, Manual Supplement, Feb. 1979—MTDC
- 35th Annual Report—Vegetative Rehabilitation and Equipment Workshop, Sept. 1981—MTDC (Available from National Technical Information Service (NTIS) U.S. Department of Commerce, Springfield, VA 22161 for \$10.50 in paper and \$4.00 in microfiche.)
- Concepts—Sod Mover, Aug. 1978—MTDC
- Aerial Burning Equipment for Plant Control, Feb. 1977—MTDC
- Handbook—Equipment for Reclaiming Strip Mined Land, Feb. 1977—MTDC
- Rangeland Drill Operations Handbook, BLM Tech. Note 289, Sept. 1976—SDTDC
- Evaluation of the "Vari-Dozer," Feb. 1974—SDTDC
- Investigation of Selected Problems in Range Habitat Improvement, Feb. 1974—SDTDC
- History—Range Seeding Equipment Committee 1946-1973, Jan. 1974—MTDC
- Results: 1972 Range Improvement Survey (27th Annual Range Seeding Equipment Committee report), Feb. 1973—MTDC
- Implement-Carrying Hitch for Forestry Use (ASAE paper), Dec. 1972—SDTDC
- Efficiency and Economy of an Air Curtain Destructor Used for Slash Disposal in the Northwest (ASAE paper), Dec. 1972—SDTDC
- Service & Parts Manual for the Contour Furrower Model RM 25, June 1970—SDTDC
- Service & Parts Manual for the Brushland Plow, June 1968—SDTDC
- Service & Parts Manual for the Rangeland Drill Models PD-10x6 and B-20x6, Aug. 1967—SDTDC

Other Publications of Interest to VREW

Private Water Systems Handbook, Midwest Plan Service, Iowa State University, Ames, IA 50011. \$2.50

Water Systems Handbook (7th Edition), Water Systems Council, 221 North LaSalle St., Chicago, IL 60601. \$6

Water Well Handbook, Keith E. Anderson, Missouri Water Well and Pump Contractors Association, Inc., P.O. Box 517, Belle, MO 65013. \$10

Evaluation of Pumps and Motors for Photovoltaic Water Pumping Systems, David Waddington and A. Herievich, Solar Energy Research Institute. Available from National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161. \$3 microfiche; \$5.25 printed copy

Rangeland Drill, reprint from "Rangelands," vol. 4, no. 3, June 1982

Glossary of Surface Mining and Reclamation Terminology, Bituminous Coal Research, Inc., 350 Hochberg Rd., P.O. Box 278, Monroeville, PA 15146. (412) 327-1600. \$2

Range Development and Improvements, 2nd edition, J.F. Vallentine, 1980. Brigham Young University Press, Provo, UT 84602. 545 pp. \$18.95

How to Build Fences with Max-ten 2—High Tensile Fence Wire, U.S. Steel Corp., P.O. Box 86 (C-1424), Pittsburgh, PA 15230. \$5 plus \$1.50 postage and handling

How to Design An Independent Power System, Terrance D. Paul, Best Energy Systems for Tomorrow, Inc., P.O. Box 280, Necedah, WI 54646, (608) 565-7200. \$4.95

From American Association for Vocational Instructional Materials (AAVIM) Engineering Center, Athens, GA 30602:

Planning for an Individual Water System, No. 600, \$6.95

Planning Fences, No. 404, \$4.25

Building Fences, No. 405, \$4.25

(For orders less than \$10 add \$1 for postage and handling; for orders over \$10 add 8 percent for postage and handling.)

Range and Pasture Seeding in the Southern Great Plains, Proceedings of a symposium on the newest grasses, seeding techniques, and seed harvesting/processing equipment, Oct. 19, 1983, Vernon, TX 76384, Texas A&M Univ., Agricultural Research and Extension Center, Vernon, TX, 115 pages, \$5.00. Order Seeding Proceedings Attn: Harold Wiedemann, Texas Agricultural Experiment Station, P.O. Box 1658, Vernon, TX 76384

Windmills and Pumps of the Southwest, Dick Hays and Bill Allen, Eakin Press, P.O. Box 23066, Austin, TX 78735, 110 pp. \$7.95

Electric Fencing for Rangelands, Special Series 27, Colorado State Univ., Agricultural Experiment Station, Fort Collins, CO. Order from Bulletin Room, Colorado State Univ., Fort Collins, CO 80523, (303) 491-6198, \$3.25 post paid

Small-Scale Solar-Powered Pumping System: The Technology, Its Economics and Advancement; main report by Sir William Halcrow and Partners in association with Intermediate Technology Power, Ltd., for the World Bank under project UNDP Project GLO/80/003, June 1983

Farm Show, published bimonthly by Farm Show Publishing, P.O. Box 704, Lakeville, MN 55044, (612) 469-5572, \$9.95/year

Drawings at SDTDC

Pipe Harrow, RM1-01 and 02

Brushland Plow, RM2-01 to 22

Oregon Press Seeder Assembly (not complete), RM 19-01 to 07

Plastic Pipe Layer Assembly, RM21-01 to 03

Reel for Laying Plastic Pipe, RM24-01

Contour Furrowers, RM25-01 to 14

Rangeland Drill Deep Furrowing Arms, RM26-46 to 61

Steep-Slope Seeder, RM33-01 to 18

Demonstration Interseeder for Rocky and Brushy Areas, RM35-01 to 09

Drawings at MTDC

B.C. Drag Chain Scarifier, No. 790

Disk Chain Implement, No. 757

Optional Dryland Sodder Bucket, No. 682

Sprig Spreader, No. 652

Sprig Harvester, No. 651

Dryland Sodder, No. 631

Tubling Planter, No. 628

Basin Blade, No. 619

Horse Trap Trigger, No. 618

Mulch Spreader, No. 611

Tree Transport Container, No. 604

Tree Transplant Trailer, No. 602

Modified Hodder Gouger, No. 583

Dixie Sager and Modified Ely Chain, No. 568

Incendiary Grenade Dispenser, No. 522

Attendance at Annual Meetings

Meeting			Participants				
Date	Place	Presiding Chairman	Federal Gov't	State Gov't	Private	Foreign	Total
Dec 1946	Portland ¹	Joseph F. Pechanec	6	0	0	0	6
Dec 1947	Ogden ¹	" "	9	0	0	0	9
Jan 1949	Denver	" "	15	0	0	0	15
Dec 1949	Ogden ¹	" "	22	0	0	0	22
Jan 1951	Billings	" "	34	5	0	0	39
Jan 1952	Boise	A.C. Hull	45	9	0	0	54
Jan 1953	Albuquerque	" "	75	15	9	1	100
Jan 1954	Omaha	" "	63	8	3	5	79
Jan 1955	San Jose	W.W. Dresskell	62	10	4	1	77
Jan 1956	Denver	William D. Hurst	86	12	1	2	101
Jan 1957	Great Falls	" "	95	10	4	0	109
Jan 1958	Phoenix	Frank C. Curtis	87	9	3	0	99
Jan 1959	Tulsa	" "	84	5	2	0	91
Jan 1960	Portland	" "	98	10	3	3	114
Jan 1961	Salt Lake City	" "	123	11	14	2	150
Jan 1962	Corpus Christi	Frank Smith	58	5	7	1	71
Jan 1963	Rapid City	" "	52	6	1	0	59
Jan 1964	Wichita	John Forsman	61	10	5	0	76
Jan 1965	Las Vegas	" "	77	8	6	0	91
Feb 1966	New Orleans	" "	47	8	5	1	61
Feb 1967	Seattle	A.B. Evanko	58	10	4	0	72
Feb 1968	Albuquerque	" "	84	16	13	1	114
Feb 1969	Great Falls ¹	" "	46	3	13	0	61
Feb 1970	Denver	" "	81	8	11	0	100
Feb 1971	Reno	" "	74	6	15	2	97
Feb 1972	Wash., D.C.	" "	48	3	6	0	57
Feb 1973	Boise	" "	60	7	7	4	78
Feb 1974	Tucson	Bill F. Currier	61	12	10	14	97
Feb 1975	El Paso ¹	Stan Tixier	49	9	11	1	70
Feb 1976	Omaha	" "	50	17	12	0	79
Feb 1977	Portland	Vern L. Thompson	63	26	31	10	130
Feb 1978	San Antonio	" "	68	26	35	6	135
Feb 1979	Casper	Ted Russell	74	35	72	12	193
Feb 1980	San Diego	" "	97	44	88	21	250
Feb 1981	Tulsa	" "	56	35	111	16	218
Feb 1982	Denver ¹	" "	60	18	68	5	151
Feb 1983	Albuquerque	" "	119	82	96	9	306
Feb 1984	Rapid City	Randall R. Hall	95	22	49	7	173
Feb 1985	Salt Lake City	" "	110	46	85	13	254
Feb 1986	Orlando	Gerald Henke	41	31	29	13	114
Feb 1987	Boise	" "	94	35	34	5	168
Feb 1988	Corpus Christi	" "	42	14	23	8	87

¹ Meeting not in conjunction with Society for Range Management meeting.

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